

Geelong Commuter Car Parking Strategy



Geelong Commuter Car Parking Strategy

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Executive summary

The development of this Geelong Commuter Car Parking Strategy has been established as a priority short-term action in the Revitalising Central Geelong Action Plan. It will deliver on the action “to develop a commuter parking strategy for train stations within Geelong to reduce all day commuter parking in central Geelong over time”.

Geelong is expected to experience significant growth in population over both the short and long terms. As Victoria’s largest regional centre, it is vital that this growth is supported by an efficient and strategic transport system. To increase the mode share of public transport for workers, students and others travelling to central Geelong, Melbourne or elsewhere, it is important that the arrival experience at the Geelong railway stations are accommodating of a variety of travel patterns and access preferences. For instance, this can be achieved through strategic pedestrian and active transport connections promoting integration with the surrounding educational, health and employment destinations without compromising ‘park and ride’ availability for commuters living within a wider catchment.

Stations analysed as part of this commuter car parking strategy include Lara, North Shore, North Geelong, Geelong, South Geelong, Marshall and Waurn Ponds.

Corio station was modelled in this study however options development and costings were not undertaken for Corio station, due to current operational and future strategic reasons as outlined in section 1.5 of this report.

In developing this commuter car parking strategy, the following tasks were undertaken:

- Background analysis of each of the seven stations, including assessment of current parking utilisation, travel behaviour (through customer surveys) and priorities for enhancement
- Comparative evaluation of the seven stations in terms of their facilities, usage and overall demand patterns
- Analysis of patronage growth potential by mode of access – including walking and cycling – through an assessment of contextual opportunities and constraints
- Demand forecasting analysis showing a variety of scenarios for future development outcomes in the corridor, including the consideration of high growth areas and infill development initiatives (particularly around Geelong station)
- Development of short (3-5 years) medium (10-15 years) and long term (20-25 years) options for addressing the growth in parking demand while also considering the impacts of technological changes (such as electric and autonomous vehicles) and other social, environmental and community objectives.

It is generally accepted by parking practitioners that 85 percent parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85 percent, it is generally more difficult for drivers to find available parking, resulting in undesirable practices such as excessive circulation or parking informally (at times in restricted areas).

A total of approximately 3,002 commuter car parking spaces are available along the study corridor. On the survey day, 2,802 (93 percent) were observed to be utilised during the peak survey period. North Shore station was the only station with significant spare parking capacity (defined as less than 85 percent utilised) with only 23 (37 percent) of the available 63 parking spaces utilised on the survey day. This is partly due to the lower proportion of V/Line services that currently stop at this station.

As part of the questionnaire surveys the commuters were asked what suggested improvements they would prioritise for each station or its transport links, 854 people were surveyed across all the stations, with 250 (29 percent) indicating a request for more car parking. These requests were most notable at North Geelong (45 percent), South Geelong (43 percent) and Marshall (34 percent), with requests lower at the other stations, Lara and Waurn Ponds (22 percent), Geelong (17 percent) and North Shore (3 percent).

Strategic modelling was undertaken to estimate the future patronage demands by access mode to each of the study railway stations under various years and scenarios. Overall, the constrained model

scenarios were more realistic and robust than the unconstrained ones and the subsequent results were used to inform the medium (2031 with no Geelong station parking) and long (2041 with no Geelong station parking) scenarios.

The model forecast indicates that the total daily passenger entries to all study stations would increase from 8,700 in 2018 to 9,700 in 2021 to 16,000 in 2031, then to 20,100 (TfV land use scenario) or 21,400 (Council land use scenario) in 2041. Similarly, the parking demand is forecast to grow from 2,500 cars in 2018 to 2,700 in 2021 to 4,800 in 2031, then to 5,800 (TfV land use scenario) or 6,800 (Council land use scenario) in 2041.

When the parking at Geelong station is removed, the other access modes to the station (kiss and ride, cycling, public transport and walking) are predicted to increase by 24 percent, 60 percent, 33 percent and 24 percent respectively. Overall the passenger entries to Geelong station would decrease slightly by 3 percent.

In this scenario it is predicted that the park and ride demand at adjacent stations North Geelong and South Geelong would increase by 85 percent and 18 percent respectively. Similarly, the park and ride demand at the further away stations of Corio, North Shore, Marshall and Waurm Ponds would increase by 14 to 16 percent, and that at Lara station would increase by 3 percent.

The tables below show the parking shortfalls in the medium (2031) and long (2041) term timeframes by station and by total across the study corridor when parking is removed from Geelong Station.

Table 1 Summary of station parking demand (cars) under all scenarios

Station	Lara		Corio		North Shore		North Geelong	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2031								
Constrained - NGP	993	-354	19	62	71	-6	853	-299
2041								
Cons.- GLU & NGP	1,848	-1,209	23	58	83	-18	1,459	-905
Station	Geelong		South Geelong		Marshall		Waurm Ponds	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2031								
Constrained - NGP	-	-	771	-218	1,326	-879	734	-361
2041								
Cons.- GLU & NGP	-	-	963	-410	1,539	-1,092	853	-480

Key: GLU – Geelong Land Use NGP – No Geelong Parking

Table 2 Total study area car parking provisions

Scenario	Predicated parking requirements	Total shortfall in commuter car parking
2018 Surveyed parking supply	3,176	-
2018 Surveyed parking demand	2,934	242
2031 Constrained model - NGP	4,767	-1,591
2041 Constrained - GLU & NGP	6,768	-3,592

Key: GLU – Geelong Land Use NGP – No Geelong Parking

The outcomes of the aforementioned tasks have aided in the development of the following short, medium and long term development programs:

- Short term development programs (next 3 to 5 years) that entail expansion of surface parking in the near term to cater to current demand trends, however arranged in a manner that would enable incremental conversion to other uses as travel behaviour evolves toward alternate modes or emerging technologies. Stations identified for parking expansion include:
 - Lara station with an additional 450 at-grade parking spaces
 - North Shore station with an additional 206 at-grade parking spaces, subject to an increase in V/Line trains stopping at this station
 - North Geelong station with an additional 350 at-grade parking spaces, however this is on DTF land which would be subject to review (if not available a parking structure may be needed to facilitate short term parking demands)
 - Marshall station with an additional 802 at-grade parking spaces on vacant land to the south of the existing southernmost car park
 - Waurm Ponds station with an additional 302 at-grade parking spaces (mixture of formalising and new spaces) on land to the east of the existing car park
- Medium term development programs (within 10 to 15 years) for each of the stations that strengthen the transition from car use to alternate modes, with a continued focus on structuring any new car parking facilities (surface or deck) in a manner that is consistent with surrounding planning contexts and convertible to other uses. These need to be co-ordinated at South Geelong, Marshall and Waurm Ponds with the Geelong to Waurm Ponds Infrastructure Upgrade Project (IUP) proposed project work.
- Long term development programs (within 20 to 25 years) for each of the stations that recognise the impact of land use changes, strategic planning objectives, autonomous vehicles, and increased use of rideshare and connecting bus services.

The precise time frames of each of these development targets is dependent on a number of factors for which their implementation remains unknown, including local policy and strategic context (for example Marshall Precinct Structure Plan) and the rate and form of population growth, the development of new connecting bus services, and the widespread deployment of autonomous vehicles. As such the development programs should be viewed as flexible design frameworks that can be adapted to the progression of any key inputs.

Overall there is potential to accommodate patronage growth within the Geelong V/Line service corridor over the time frames outlined, though a shift toward more sustainable forms of access will be required to optimise the efficiency of passenger delivery to each of the stations.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) has been commissioned by Department of Transport (DoT) to prepare a Geelong Commuter Car Parking Strategy.

1.1 Study background and objectives

1.1.1 Background

The development of this Geelong Commuter Car Parking Strategy has been established as a priority short-term action in the Revitalising Central Geelong Action Plan. It will deliver on the action “*to develop a commuter parking strategy for train stations within Geelong to reduce all day commuter parking in central Geelong over time*”.

Geelong is expected to experience significant growth in population over both the short and long terms. As Victoria's largest regional centre, it is vital that this growth is supported by an efficient and strategic transport system. To increase the mode share of public transport for workers, students and others travelling to central Geelong, Melbourne or elsewhere, it is important that the arrival experience at the Geelong railway stations are accommodating of a variety of travel patterns and access preferences. For instance, this can be achieved through strategic pedestrian and active transport connections promoting integration with the surrounding educational, health and employment destinations without compromising 'park and ride' availability for commuters living within a wider catchment.

1.1.2 Objectives

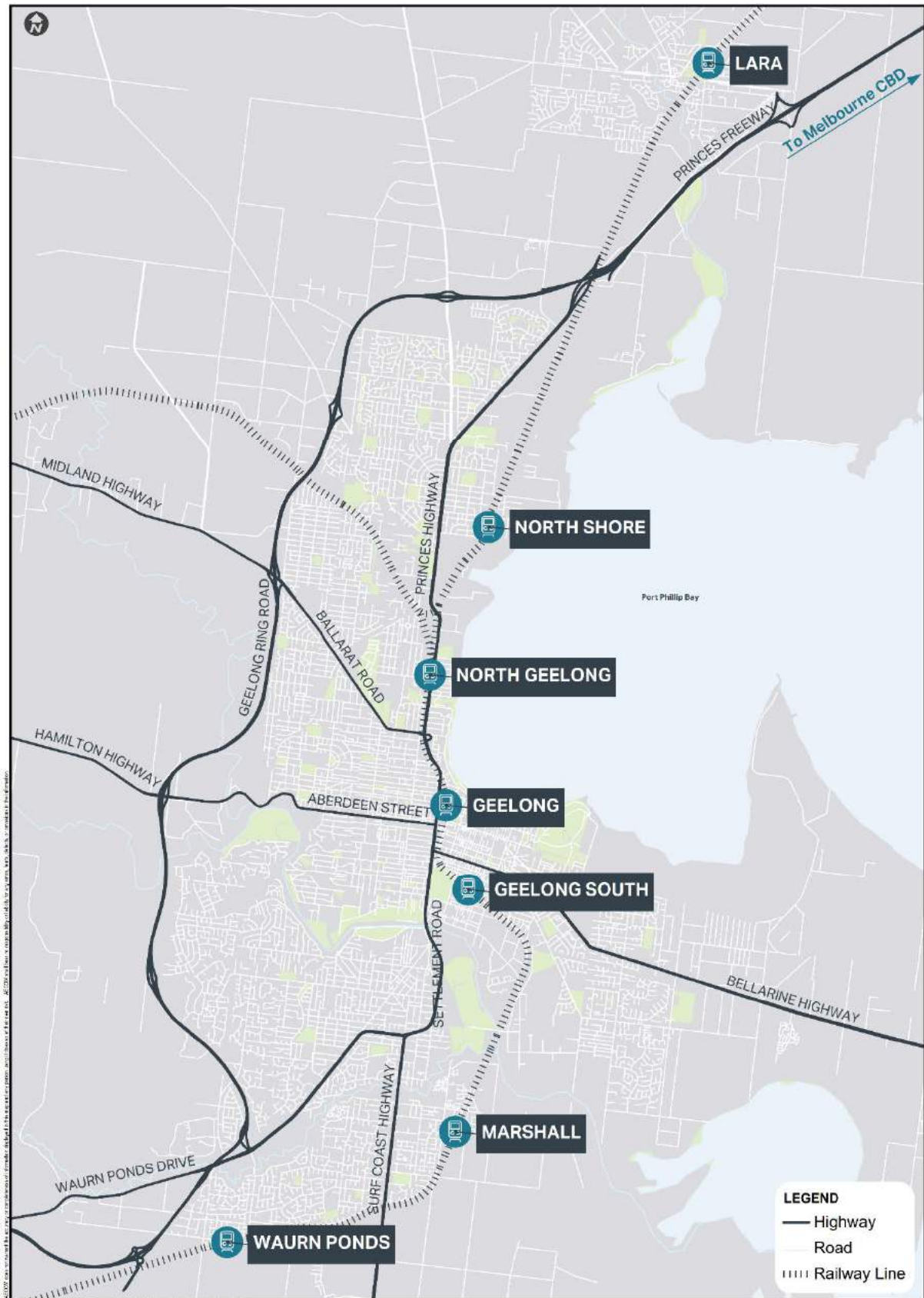
To devise a strategy that will enhance the economic activity within Geelong via a more effective use of commuter parking, it is necessary to first understand what the demand is for commuter parking and how effectively it is being managed at each railway station. This study aims to satisfy these requirements through the following objectives:

- Consider the impacts of removing car parking at Central Geelong Railway Station and to evaluate the ability of the remaining railway stations under this study to accommodate the redistributed car parking demand, also considering the underlying growth in parking demand due to population growth in Geelong.
- Evaluate the existing commuter car parking infrastructure provided at each station in the study area corridor.
- Identify the current demand for commuter car parking and the use of existing infrastructure for both commuter and non-commuter purposes at each station, in both the morning and evening peak periods.
- Estimate the future demand for commuter car parking.
- Identify the future infrastructure needs at the railway stations and potential options to provide additional capacity.
- Improve sustainable mode transport infrastructure provision at each of the stations and investigate potential improvements which can reduce the need to travel by car.

1.2 Study locations

This study is focussed on the Geelong railway corridor stations at Lara, North Shore, North Geelong, Geelong, South Geelong, Marshall and Waurin Ponds. These are indicated in Figure 1.

Figure 1 Study locations



1.3 Structure of report

This report is structured as follows:

- Chapter 2.0 summarises the existing and planned infrastructure at each of the study railway stations, as well as key statistics on station usage informed by parking and customer surveys.
- Chapter 3.0 compares the existing study corridor usage patterns along the corridor, as informed via the various transport surveys.
- Chapter 4.0 discusses the patronage growth opportunities for each station by mode of access.
- Chapter 5.0 outlines the patronage forecasting modelling and key findings.
- Chapter 6.0 provides a framework and indicative strategic development program for each station for the short, medium and long terms, for the purposes of accommodating the projected growth in parking demand whilst being responsive to emerging travel trends and development patterns.
- Chapter 7.0 summarises the next steps to further the carparking and access development programs at the seven stations.
- Chapter 8.0 provides a summary of the key findings and recommendations.

1.4 Reference documents

The following documents have been consulted in the preparation of the Geelong Commuter Carparking Strategy:

- Planning schemes and plans:
 - Revitalising Central Geelong Action Plan 2016
 - City of Greater Geelong Planning Scheme
 - Integrated Comprehensive Transport Plan 2015
 - G21 Region Public Transport Strategy
- Concurrent projects:
 - Regional Network Development Plan
 - Central Geelong Car Parking Discussion Paper (an input to forthcoming Strategy)
 - Geelong Station Precinct Land Use and Development Strategy
 - Central Geelong Public Open Space Strategy
 - Central Geelong Community Infrastructure Strategy
 - Central Geelong Infrastructure Services Review
 - Geelong Settlement Strategy, October 2018
 - Johnstone Park Masterplan
 - Land redevelopment proposal for the Barwon Water site at South Geelong station
- Studies:
 - Geelong to Waurn Ponds Rail Infrastructure Upgrade, Urban Design Framework, Jackson Burrows Architects, Final – March 2018
 - Geelong to Waurn Ponds Rail Infrastructure Upgrade, Technical Discipline Report – Stations and Station Precinct Reference Design, Transport for Victoria, (reference 5000182-0000-REP-AA0001), Revision 02, 16 March 2018

This report also relates to City of Greater Geelong's Settlement Strategy. The study supports the Urban Settlement Strategy of Geelong City, specifically Recommendation 6 (Directions a – c). It also supports the Settlement Strategy's policy which designates Lara as an 'urban growth area' or 'district

town'. Armstrong Creek is nominated as a 'growth area' and Lovely Banks and Batesford are nominated as Northern and Western Geelong Growth Areas. These growth areas will be a significant source of commuters utilising the railway stations. The most recent census data indicates that growth reached 2.7 percent per annum in 2015-16. It is not yet clear if this rate of growth will be maintained in the medium to long term. In the last two years (2014-16) population growth has reached an unprecedented level of 2-2.5 percent.

Population has been growing at a rate higher than Greater Melbourne and statewide, although this growth is still less than the fastest growing municipalities in Melbourne's growth areas. This information has been considered through the appropriate development of scenarios and the development of options.

This study has investigated additional scenarios in its VITM modelling to consider the relevant population growth scenarios outlined within the Urban Settlement Strategy through close consultation with Geelong City.

1.5 Other study dependencies

Corio station was modelled in this study however options development and costings were not undertaken for Corio station, primarily due to the following:

- a. Modelling and mapping indicate only approximately 100 commuter car parking spaces can be accommodated at Corio Station due to constraints of the railway line, School Road and the infrastructure of the refinery on the east, west and south of the station site.
- b. The current location of Corio station is removed from Melbourne Road. Apart from the refinery and Geelong Grammar school, the developed areas of Corio are on the west of Melbourne Road. Its obscure location combined with the low provision and usage of the commuter car park at Corio station leads the current location to be an unattractive option for park and ride commuters.
- c. Its contribution to the overall available car parking pool considered under this study is minimal. Data from Vline indicates an average occupancy of three spaces out of 36 with 15 percent occupancy.
- d. Zone 2 myki tickets are acceptable at Lara station (zone 2/3/4) but not in Corio station (zone 3/4), accordingly there is no incentive for commuters to travel to Corio as it is perceived as an uneconomic option and a roundabout destination.
- e. Lara station is only 8 km (about 7 minutes) by private vehicle from Corio station. Commuters prefer to park at Lara, and Lara station is conveniently located for the vast majority of customers including those from the future growth areas (particularly the Northern Geelong Growth Area).
- f. City of Greater Geelong in consultation with Barwon Water is preparing redevelopment options for Barwon Water's site adjacent to South Geelong station, which in addition to the UDF surrounding this station, would have implications for accommodating commuter car parking demand here.
- g. City of Greater Geelong is preparing the Marshall Precinct Structure Plan (PSP) with implications for accommodating commuter car parking demand at Marshall Station.
- h. Armstrong Creek Transit Corridor study is not considered in the ACTC due to timing affecting the commencement of both studies.
- i. Western Rail Plan study has not considered the WTP.

2.0 Existing conditions

This chapter outlines the existing conditions and survey results for each of the stations within the study area. Please see Appendix **A** for a complete spatial assessment showing locations of facilities for various modes of access and Appendix **B** for an expanded version of the survey analysis including further statistics on various aspects of station access and customer use.

2.1 Lara station

2.1.1 Overview

The existing conditions at Lara station are summarised in Table 3.

Table 3 Existing conditions - Lara station

Item		Description
Station Accessibility	Services	Lara station has an island platform with Platform 1 providing V/Line services to Southern Cross and Platform 2 providing V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurn Ponds. The station is staffed part-time.
	Platform Access	Single access point onto the platforms and station with an at-grade pedestrian crossing.
	Vehicle Access	Access to the station carpark is provided via various cross-overs on Hicks Street.
	Walking	Hicks Street provides footpaths on its eastern side only. Footpaths are provided intermittently between parking aisles in the station carpark onwards to the main station entrance. Footpaths are provided along the north of the carpark from McClelland Avenue to the station entrance.
	Cycling	McClelland Avenue, Mill Road and Rennie Street (bicycle lanes provided) are part of the existing principal bicycle network. A proposed off-road bicycle path is proposed from Little River to the existing Bacchus Marsh Road on road bicycle paths.
	Bus	Serviced by bus routes 10, 11 and 12
Station Facilities	Car parking	589 off-street car parking spaces (includes 14 disabled spaces). An informal (gravel) parking area was sealed and now caters for approximately 50 cars.
	Bus facilities	One bus stop for three bus services.
	Kiss and Ride	Three five-minute bays located immediately east of the pedestrian level crossing
	Bicycle facilities	Nine bicycle loops (capacity for 18 bicycles). Also, six bicycle lockers
	Taxi facilities	None
	Wheelchair accessible	Yes. Ramp to access platforms.
	Tactile paths	No
	Hearing loop	No
On-street carparking	Hicks Street has 29 parking spaces, with 21 spaces under 1/4P restriction 8am to 8pm (Mon-Sun) and eight spaces with no restrictions. Informal overflow parking was also observed on the western verge along Hicks Street.	

2.1.2 Car parking

A total of 602 off-street carparking spaces were recorded for Lara station. These consist of:

- 575 car parking spaces with no restrictions
- Three five-minute kiss and ride spaces
- 14 disabled spaces.

In addition, it was observed that the gravel area to the north-east of the off-street carpark is also used informally by commuters. The parking capacity in this area was observed on site to cater for 50 cars.

The occupancy survey results for the morning and evening peak periods are shown in Figure 2 and Figure 3. Note it is generally accepted by parking practitioners that 85 percent parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds this level it is difficult for drivers to find available parking, resulting in undesirable parking practices such as excessive circulation or parking informally (at times in restricted areas).

Figure 2 Lara station off-street car parking occupancy – morning peak period (6.00-9.30 am)

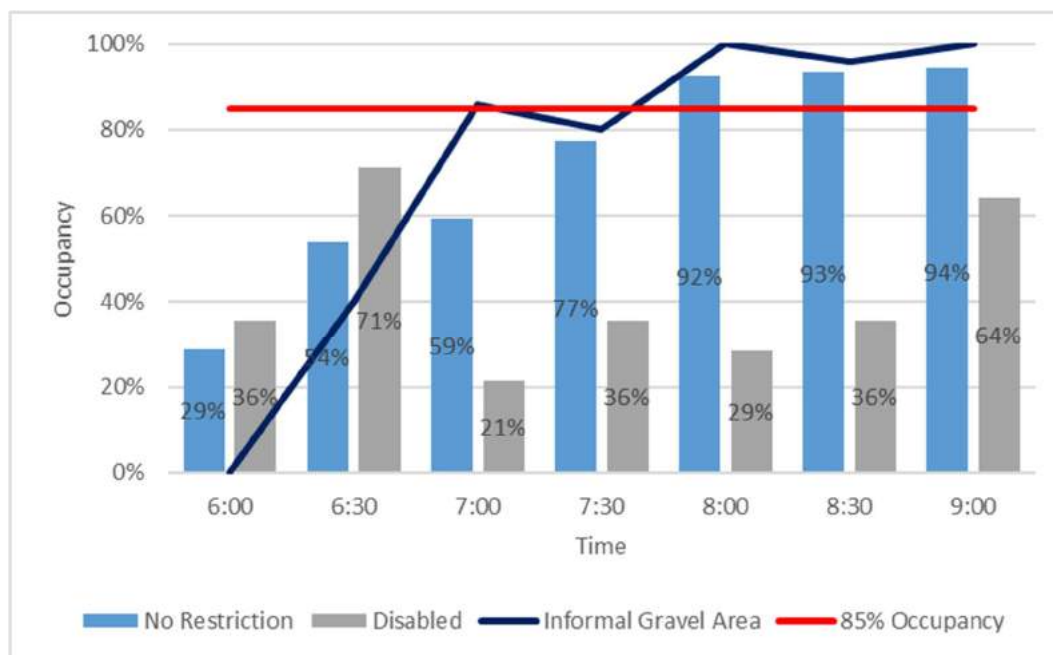
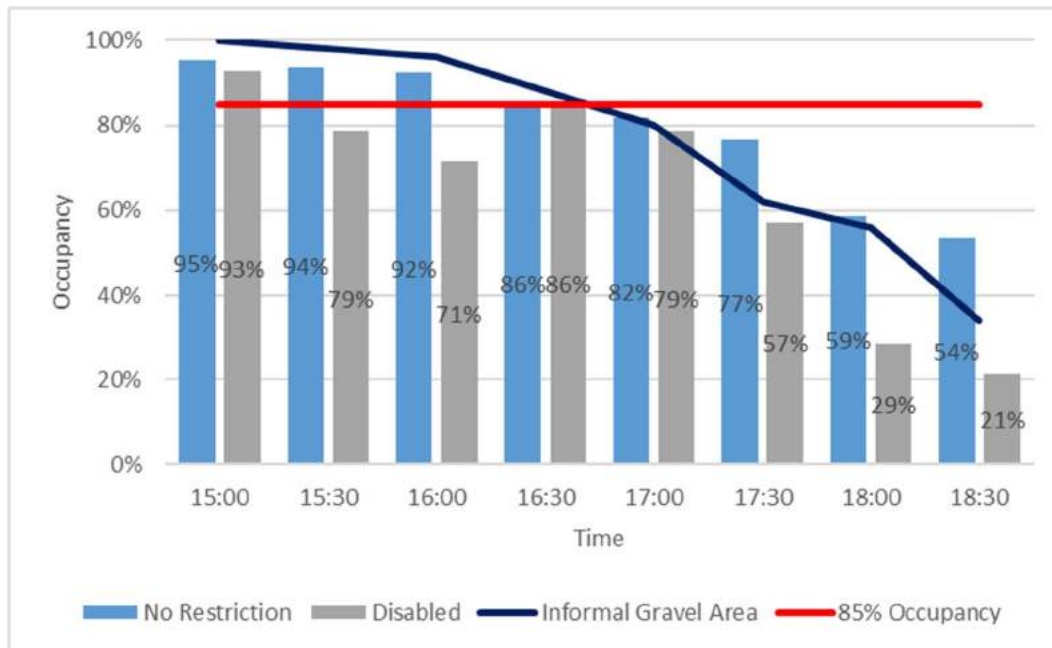


Figure 3 Lara station off-street car parking occupancy – evening peak period (3.00-7.00 pm)



A total of 54 on-street car parking spaces were also recorded near Lara station, with the following provided:

- 29 spaces located on Hicks Street with eight unrestricted and 21 with 15-minute time restrictions
- 25 spaces located on Bates Road with 10 unrestricted and 13 with 15-minute time restrictions.

The occupancy survey results of the on-street car parking near Lara station for the morning and evening peak periods are shown in Figure 4 and Figure 5. As shown there is spare on-street parking supply, however this is most likely due to the time restrictions put in place to deter overspill from the Lara station car park.

Figure 4 Lara station on-street car parking occupancy – morning peak period (6.00-9.30 am)

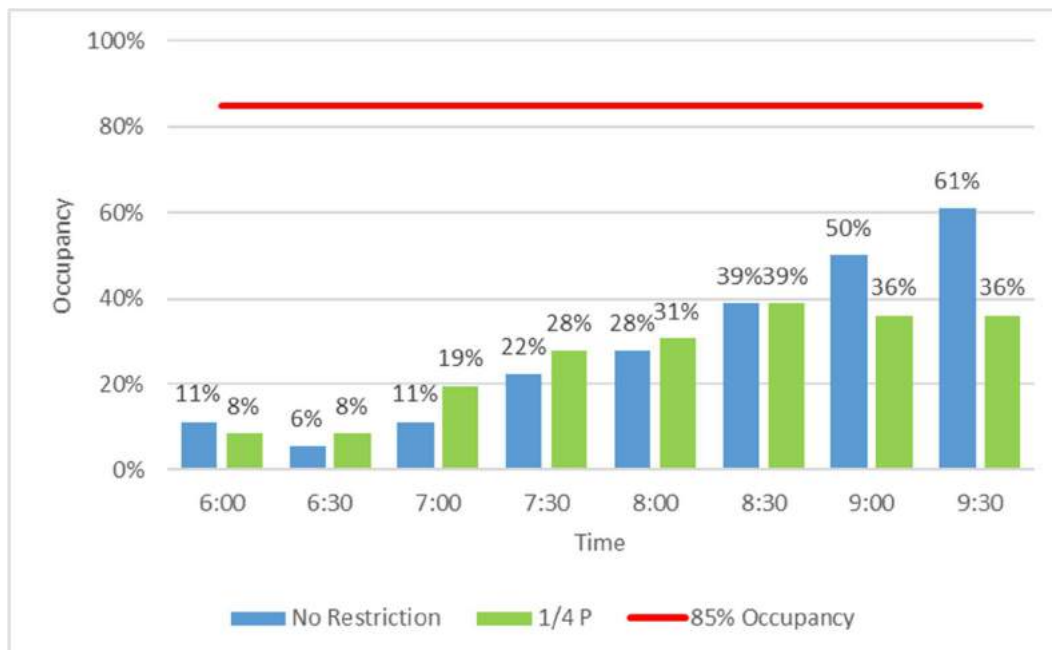
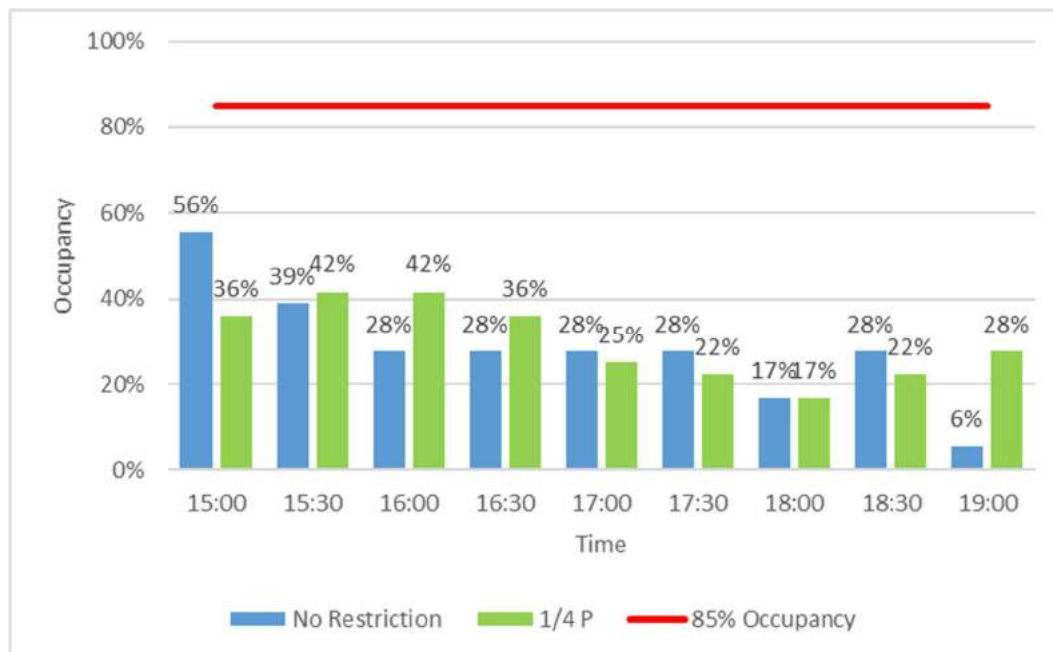


Figure 5 Lara station on-street car parking occupancy – evening peak period (3.00-7.00 pm)



2.1.3 Bicycle parking

Lara station has capacity for a total of 24 bicycles split between loops (18) and lockers (6). Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 4 and Table 5.

Table 4 Lara station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	18	5	8	10	12	12
	Lockers	6	0	0	0	0	0
	Total	24	5	8	10	12	12
	% Occupancy		21%	33%	42%	50%	50%
Informal bicycle parking			0	0	0	0	0

Table 5 Lara station – Supply and demand for bicycle parking, PM peak

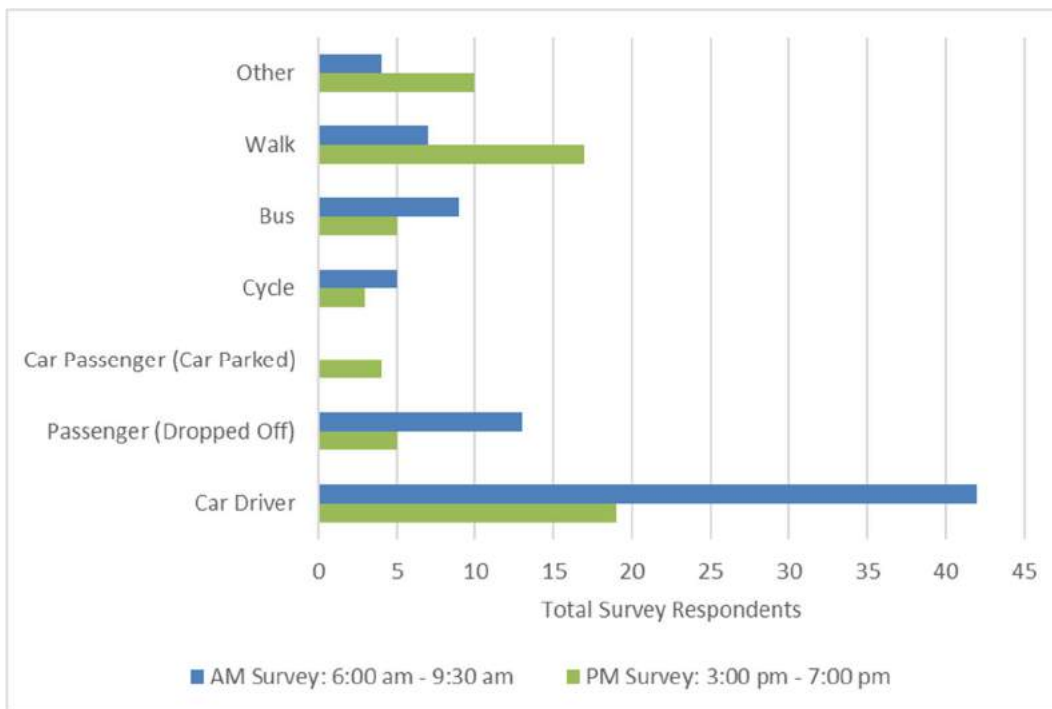
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	18	11	11	10	5	3
	Lockers	6	0	0	0	0	0
	Total	24	11	11	10	5	3
	% Occupancy		46%	46%	42%	21%	13%
Informal bicycle parking			1	1	1	1	0

As shown from Table 4 and Table 5, there is sufficient bicycle parking capacity at Lara Station to meet current demand, with the peak bicycle parking occupancy being at 50 percent, yet the imbalance in use between loops and lockers may suggest expansion of the former as more cycling is encouraged.

2.1.4 Mode share

The mode choice by the survey respondents on how they travelled to Lara station is shown in Figure 6.

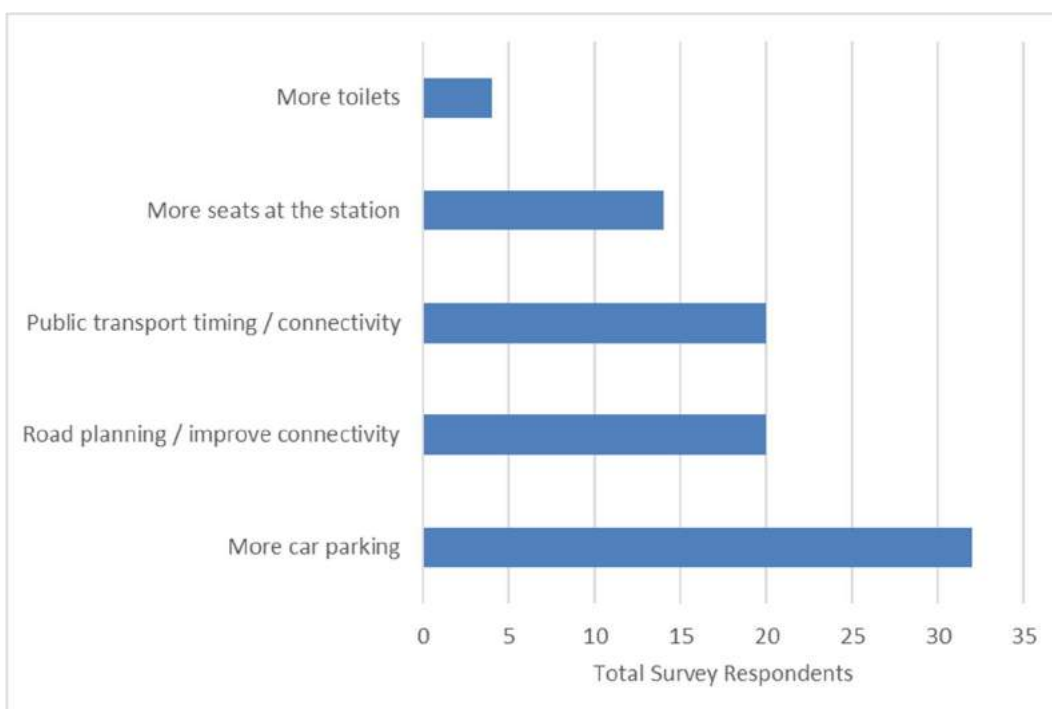
Figure 6 Lara station – commuter modes of station access



2.1.5 Customer suggested improvements

Lara station commuters were asked what improvements they would prioritise for the station or transport links. A summary of the most frequently occurring responses are provided in Figure 7.

Figure 7 Lara station – suggested improvements



2.2 North Shore station

2.2.1 Overview

The existing conditions at North Shore station are summarised in Table 6.

Table 6 Existing conditions – North Shore station

Item		Description
Station Accessibility	Services	North Shore station consists of three platforms, platform 1 and 2 are situated as an island platform and Platform 3 is a side platform. Platform 1 provides V/Line services to Southern Cross. Platform 2 provides V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurn Ponds. Platform 3 is The Overland train which operates between Southern Cross and Adelaide Parklands. The station has no station building and is un-staffed.
	Platform Access	Single access point onto Platform 3 and single access point onto island platforms 1 and 2 via at-grade pedestrian crossing.
	Vehicle Access	Access to the station carpark is provided via a single cross-over from Station Street
	Walking	Footpaths provided on all local roads. Pedestrians must cross the railway line at-grade to access platforms 1 and 2.
	Cycling	Bicycle lanes provided on Station Street and Abery Road, which are also part of the principal bicycle network.
	Bus	Serviced by bus routes 1, 22 and 23
Station Facilities	Car parking	65 off-street carparking spaces (includes two disabled spaces). No motorcycle bays
	Bus facilities	No internal bus facilities. Bus stops are located on Station Street in direct vicinity to station.
	Kiss and Ride	None
	Bicycle facilities	Five bicycle loops (capacity for 10 bicycles). Spirals with capacity for eight bicycles.
	Taxi facilities	None
	Wheelchair accessible	Yes. Ramp to access platforms
	Tactile paths	Two disabled parking spaces
	Hearing loop	No
On-street carparking		No associated on-street parking, since off-street car park has sufficient capacity.

2.2.2 Car parking

A total of 65 off-street carparking spaces were recorded at North Shore station. These consist of:

- 63 car parking spaces with no restrictions.
- Two disabled spaces.

The occupancy survey results of the off-street carpark for the morning and evening peak periods are shown in Figure 8 and Figure 9, in comparison with the generally accepted 85 percent capacity benchmark.

Figure 8 North Shore station off-street car parking occupancy – morning peak period (6.00-9.30 am)

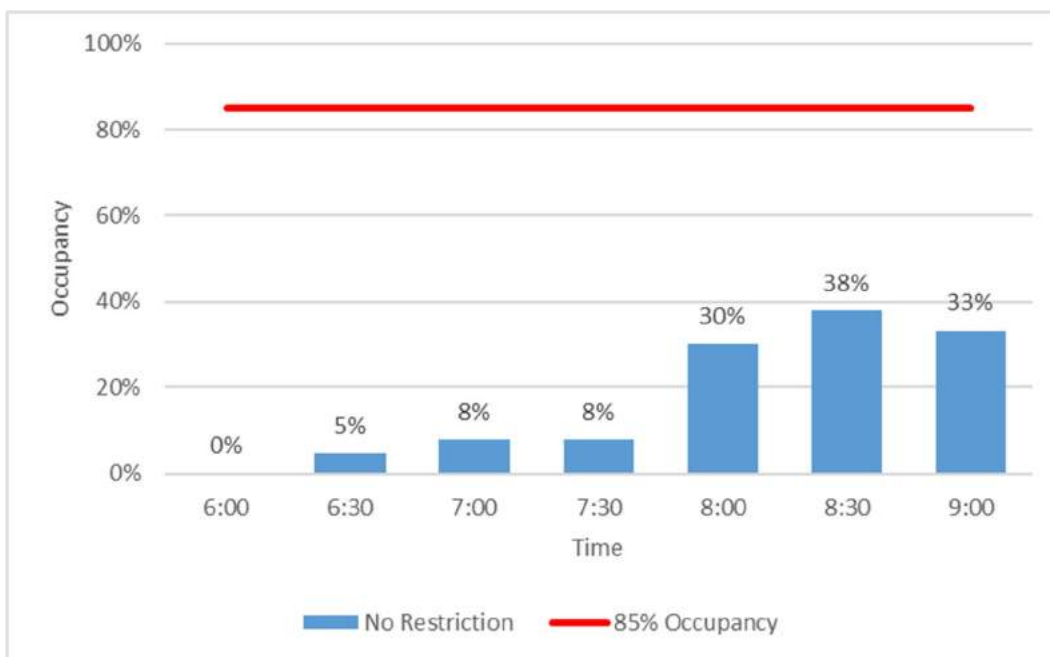
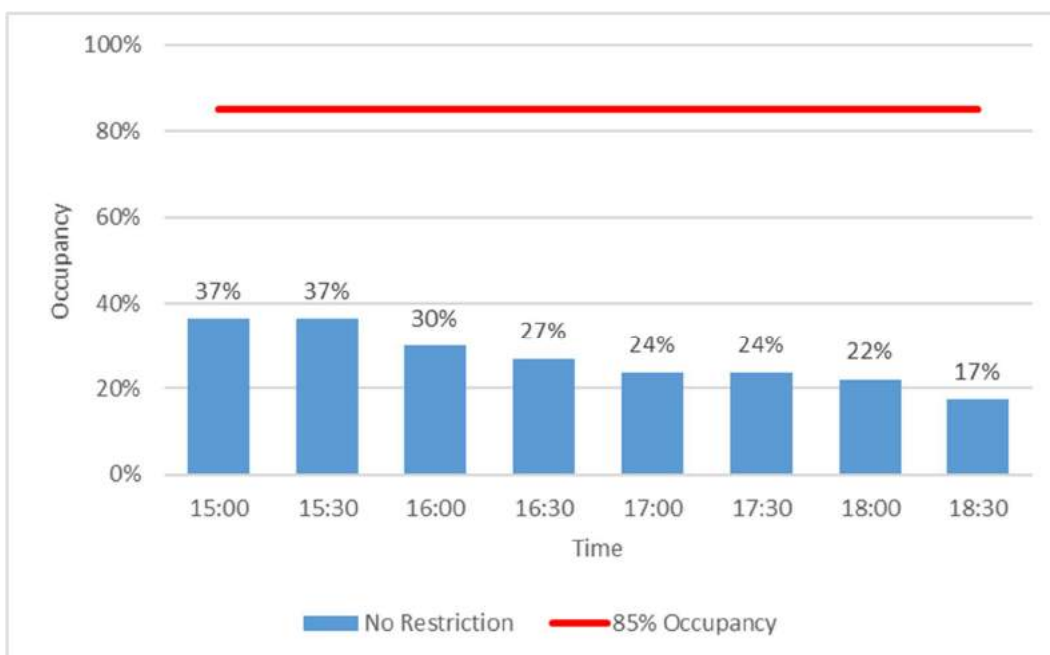


Figure 9 North Shore station off-street car parking occupancy – evening peak period (3.00-7.00 pm)



As shown from the North Shore station car parking occupancy analysis there is spare car parking capacity in both the surveyed morning and evening periods.

No on-street car parking surveys were conducted near North Shore station, since following the initial site observations the presence of spare parking capacity within the station carpark negated the need for any commuters to park on-street.

2.2.3 Bicycle parking

North Shore station has capacity for a total of 18 bicycles split between loops (10) and spirals (8).

Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 7 and Table 8.

Table 7 North Shore station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	10	0	0	0	0	0
	Spirals	8	0	0	0	0	0
	Total	18	0	0	0	0	0
	% Occupancy			0%	0%	0%	0%
Informal bicycle parking			0	0	0	0	0

Table 8 North Shore station – Supply and demand for bicycle parking, PM peak

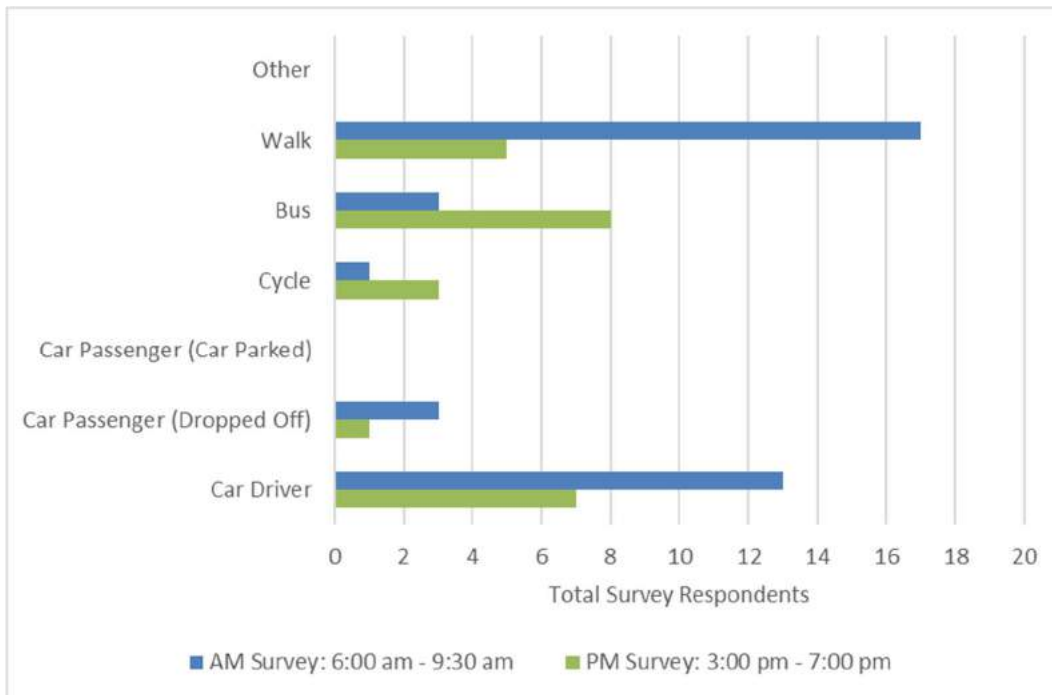
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	10	0	0	0	0	0
	Spirals	8	1	1	0	0	0
	Total	18	1	1	0	0	0
	% Occupancy			6%	6%	0%	0%
Informal bicycle parking			0	0	0	0	0

As shown above there is sufficient bicycle parking capacity at North Shore station to meet current demand.

2.2.4 Mode share

The mode choice by the survey respondents on how they travelled to North Shore station is shown in Figure 10.

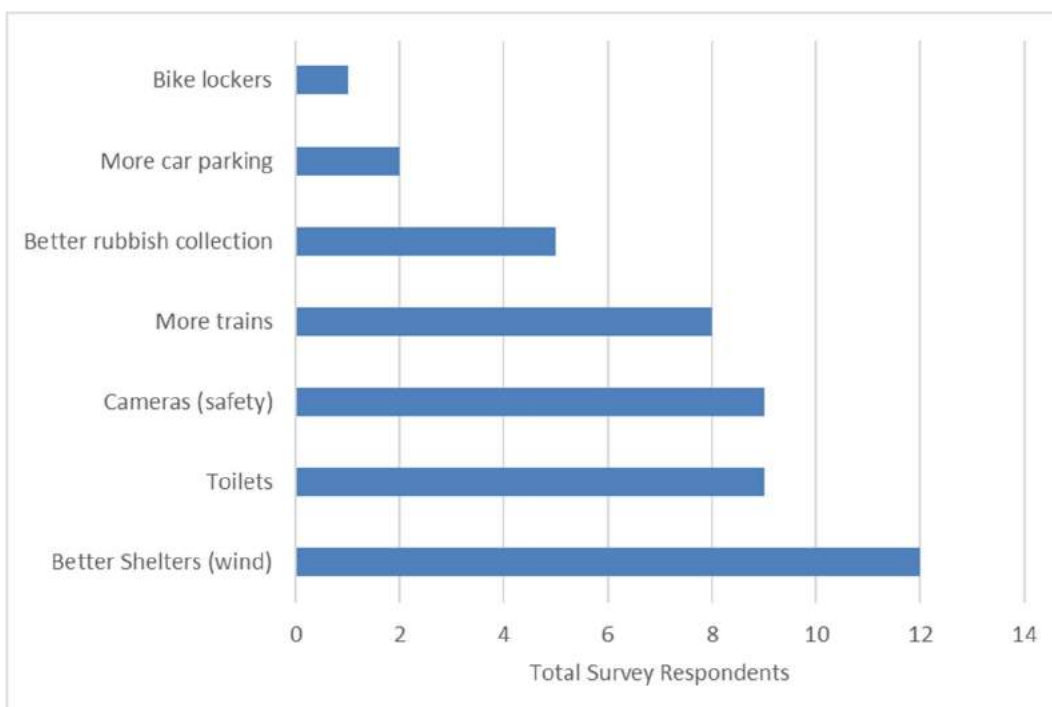
Figure 10 North Shore station – commuter modes



2.2.5 Customer suggested improvements

North Shore station commuters were asked what suggested improvements they would prioritise for the station or its transport links. A summary of the most frequently occurring responses is provided in Figure 7.

Figure 11 North Shore station suggested improvements



2.3 North Geelong station

2.3.1 Overview

The existing conditions at North Geelong station are summarised in Table 9.

Table 9 Existing conditions – North Geelong station

Item		Description
Station Accessibility	Services	North Geelong station consists of two side platforms on either side of the rail line connected via a grade-separated pedestrian crossing. Platform 1 provides V/Line services to Southern Cross and Platform 2 provides V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurn Ponds. The station has a station building on the western side which is staffed part-time.
	Platform Access	Two access points for the eastern platform and three for the western platform.
	Vehicle Access	The station has vehicle access either side of the railway line. On the eastern side the station is accessed via a one-way service road connecting off the Princes Highway. On the western side the station carparks are accessed via Victoria Street.
	Walking	All local streets have footpaths provided. Key pedestrian links to the station are provided via the Princes Highway / Victoria Street signalised intersection which has pedestrian crossings incorporated on all approaches and a zebra crossing on the service road to the east of the railway line. A pedestrian underpass is present to the south of the station for platform access on either side of the rail way line.
	Cycling	Victoria Street to the west of the railway line has on-road bicycle lanes. Shared path on the east of the railway line along the Princes Highway service road.
	Bus	Serviced by bus routes 20 and 24
Station Facilities	Car parking	454 off-street carparking spaces (includes 10 disabled spaces). An informal (gravel) parking area is available which caters for approximately 100 cars.
	Bus facilities	No internal bus facilities. A bus stop (no.20) is located on the eastern side of the station via one-way service road off Princes Highway, and on western side (no.24) on Victoria Street west of Baxter Road.
	Kiss and Ride	Three five-minute bays on the eastern side. Seven kiss and ride spaces on the western side next to the station building (15 mins)
	Bicycle facilities	Bicycle loops with capacity for 26 bicycles, along with bicycle lockers catering for eight bicycles.
	Taxi facilities	Taxi zone on the eastern side to the north of bus stop. Two taxi spaces present
	Wheelchair accessible	Yes. Ramp to access platforms. Toilets are accessible.
	Tactile paths	No
	Hearing loop	No
On-street carparking		No associated on-street parking, for the purposes of this study assumed that parking on service road is off-street parking as associated with station usage.

2.3.2 Car parking

A total of 466 off-street carparking spaces were recorded at North Geelong station. These consist of:

- 444 car parking spaces with no restrictions
- Seven 15-minute kiss and ride spaces
- Three 5-minute kiss and ride spaces
- 10 disabled spaces.

In addition, it was observed that the gravel area to the north of the main off-street car park is used informally by commuters. The parking capacity in this area was observed on site to cater for 100 cars.

The occupancy survey results of the off-street carpark for the morning and evening peak periods are shown in Figure 12 and Figure 13, in comparison with the generally accepted 85 percent capacity benchmark.

Figure 12 North Geelong station off-street car parking occupancy – morning peak period (6.00-9.30 am)

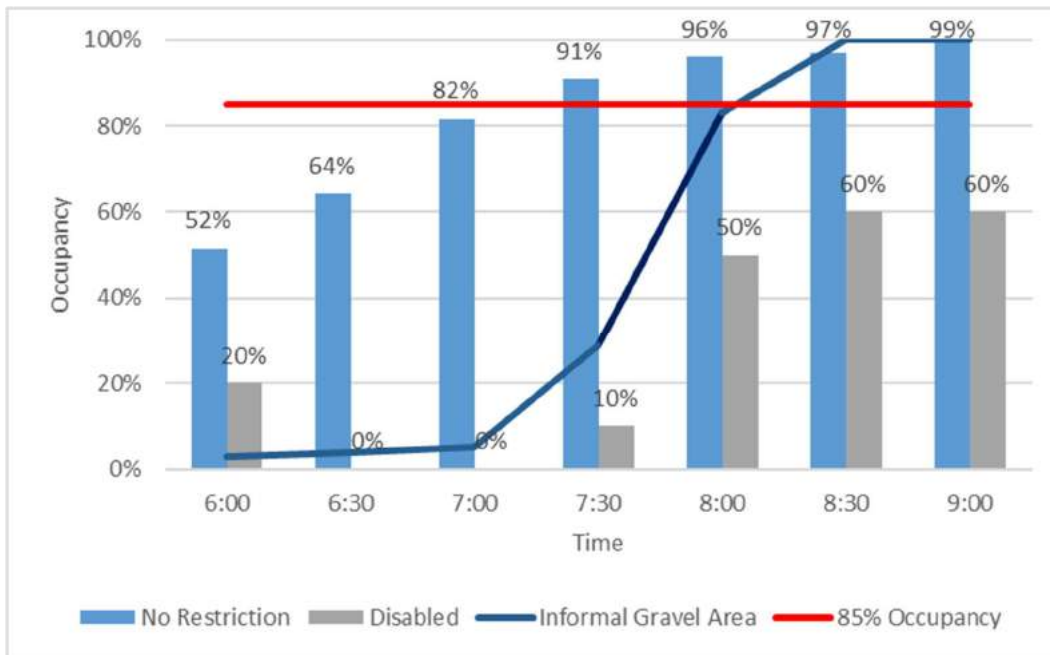
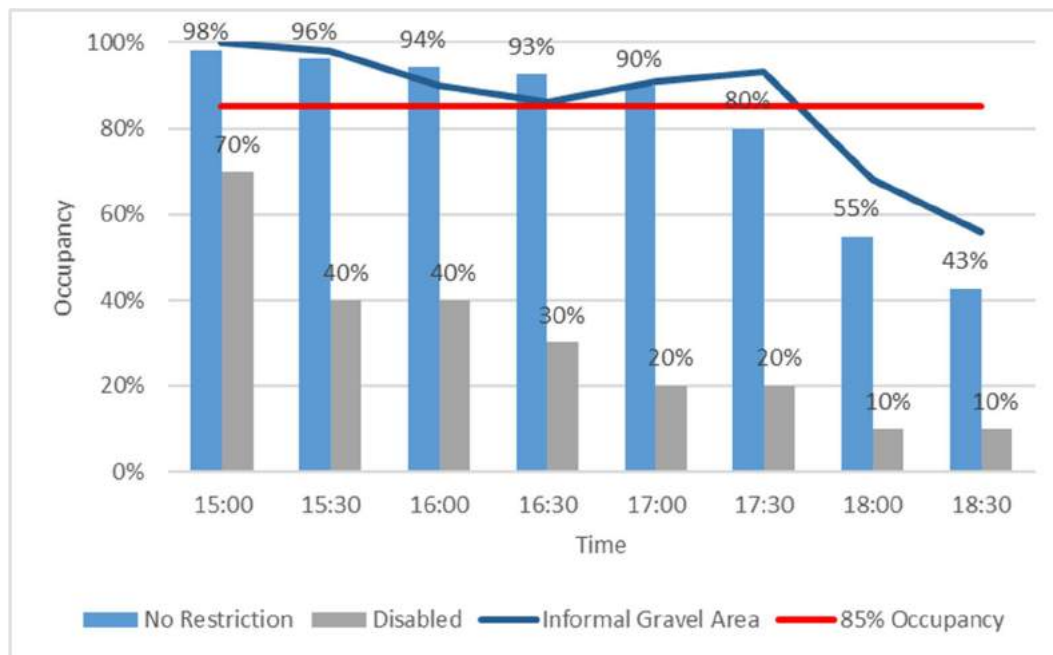


Figure 13 North Geelong station off-street car parking occupancy – evening peak period (3.00-7.00 pm)



On-street parking was not surveyed given initial site observations indicated no on-street car parking at the station. However, the customer survey responses included a sample of people who claimed to have parked on-street nearby the station.

2.3.3 Bicycle parking

North Geelong station has capacity for a total of 34 bicycles split between loops (26) and lockers (8).

Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 10 and Table 11.

Table 10 North Geelong station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	26	0	4	5	5	5
	Lockers	8	0	0	0	0	0
	Total	34	0	4	5	5	5
	% Occupancy		0%	12%	15%	15%	15%
Informal bicycle parking			0	0	0	0	0

Table 11 North Geelong station – Supply and demand for bicycle parking, PM peak

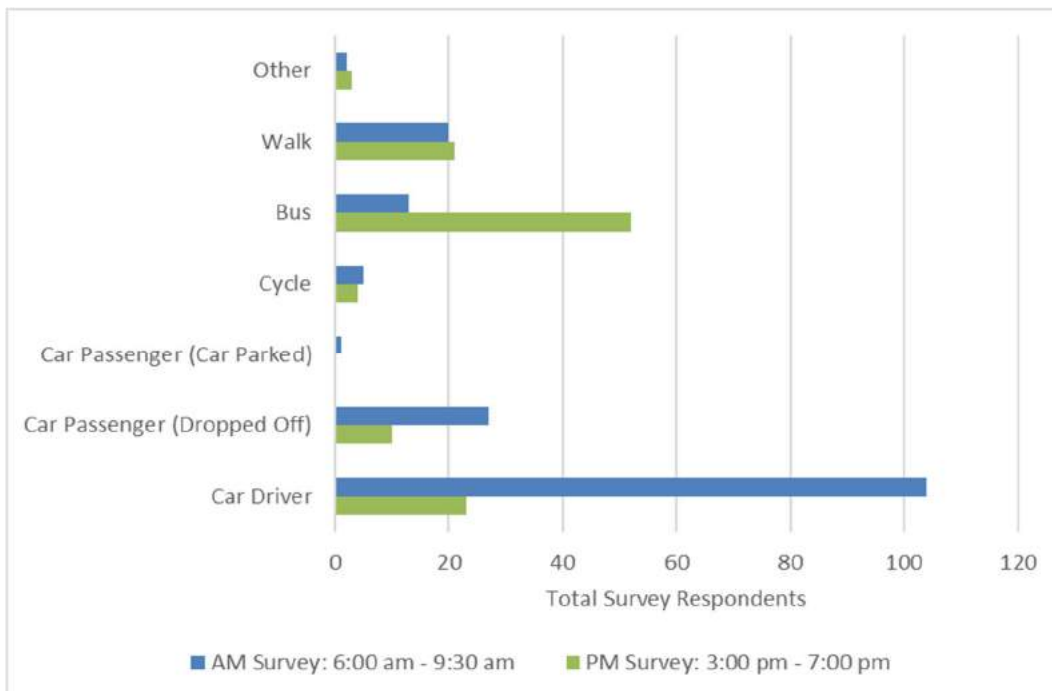
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	26	5	5	5	4	1
	Lockers	8	0	0	0	0	0
	Total	34	5	5	5	4	1
	% Occupancy		15%	15%	15%	12%	3%
Informal bicycle parking			1	1	1	1	0

As shown from Table 10 and Table 11 there is sufficient bicycle parking capacity at North Geelong station to cater to current cycling demand, with a peak bicycle parking occupancy of 15 percent.

2.3.4 Mode share

The mode choice by the survey respondents on how they travelled to North Geelong Station is shown in Figure 14.

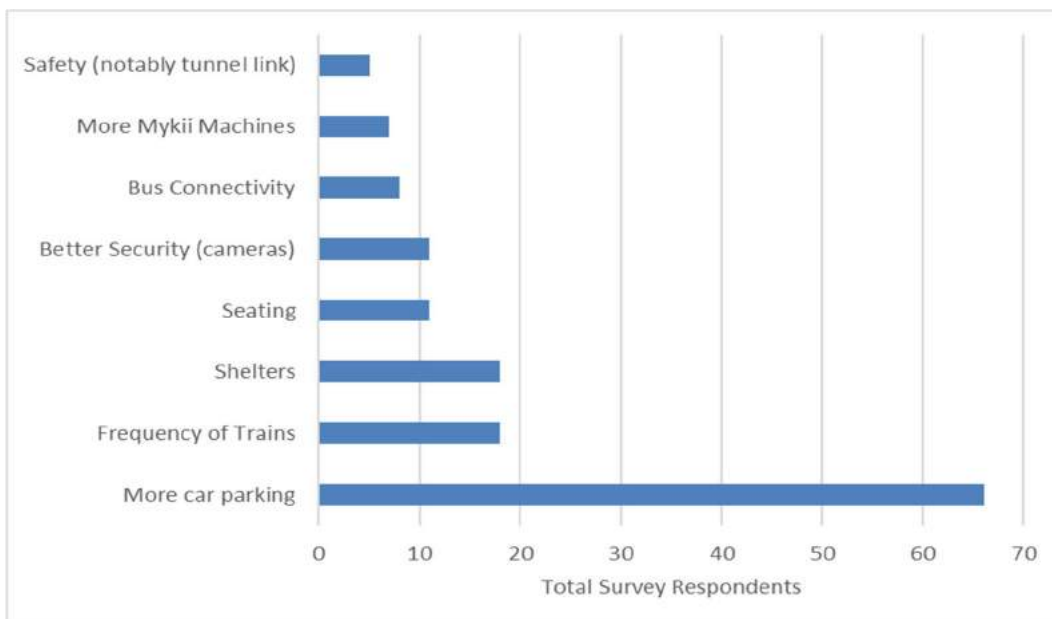
Figure 14 North Geelong station – commuter modes



2.3.5 Customer suggested improvements

North Geelong commuters were asked what suggested improvements they would prioritise for the station or its transport links. A summary of the most frequent responses is provided in Figure 7.

Figure 15 North Geelong station – suggested improvements



2.4 Geelong station

2.4.1 Overview

The existing conditions at Geelong station are summarised in Table 12.

Table 12 Existing conditions - Geelong station

Item		Description
Station Accessibility	Services	Geelong station consists of three platforms, platform 1 is a side platform and platforms 2 and 3 are an island platform. Platform 1 provides V/Line services to South Geelong, Marshall, Waurn Ponds and Warrnambool. Platform 2 provides V/Line services towards Southern Cross when Platform 3 is occupied. Platform 3 provides V/Line services towards Southern Cross The station has a station building and is staffed.
	Platform Access	Six access points to access the platforms (three through the station building, one via the bus loop area, one via the eastern carpark and one via the staircase from Brougham Street)
	Vehicle Access	The station has vehicle access either side of the railway line. On the eastern side the station is accessed via Trainshed Way which forms a signalised intersection with Mercer Street and Bayley Street. On the western side the station carparks are accessed via a cross-over which forms part of the Latrobe Terrace and Gordon Avenue signalised intersection.
	Walking	All local streets have footpaths provided. Pedestrian crossings are incorporated on all approaches at the Mercer Street / Bayley Street and Latrobe Terrace / Gordon Avenue signalised intersections.
	Cycling	Bicycle lanes provided on Mercer Street
	Bus	Serviced by bus routes 22, 24, 25, 30, 31, 32, 40, 41, 42, 43, 50, 51, 55, 56, 60 and 61
Station Facilities	Car parking	Eastern station car park has a total of 97 parking spaces, with only 21 spaces being unrestricted. V/Line customer only (41), kiss and ride (12) and motorcycle only (9) spaces. The adjacent 102 permit-only spaces are associated with the Law Court and are not available to commuters. Western station car park has 443 car parking spaces with no restrictions.
	Bus facilities	Bus interchange (with 11 bus bays) is located to the southeast of the station and is accessed via Railway Terrace.
	Kiss and Ride	12 kiss and ride bays on eastern side of station
	Bicycle facilities	Bicycle loops with capacity for 18 bicycles. Bicycle spirals catering for 14 bicycles and bicycle lockers for four bicycles. A Parkiteer Cage is also present with a capacity of 26 bicycles (12 loops and 14 hanging).
	Taxi facilities	Yes, six taxi bays provided
	Wheelchair accessible	Yes. Elevator and ramps to access platforms 2 and 3.
	Tactile paths	Yes
	Hearing loop	Yes
On-street carparking	No associated on-street parking. On-street carparking in the immediate area is paid and highly unlikely to be used by commuters.	

2.4.2 Car parking

A total of 642 off-street carparking spaces were recorded at Geelong Station. These consisted of:

- Eastern car park (totalling 97 car parking spaces):
 - 44 V/Line customer only parking spaces
 - 21 Unrestricted parking spaces
 - 12 kiss and ride parking spaces
 - Nine motorcycle parking spaces
 - Six taxi parking spaces
 - Four disabled parking spaces
 - Two kiosk staff permit parking spaces
 - A single no stopping parking space which is authorised for V/Line parking only.
- Western car park a total of 443 unrestricted parking spaces are provided.

Due to the parking demands at Geelong Station patrons have also been observed to park informally within the car park itself, even on verges and undesignated areas, sometimes blocking other vehicles.

In general, the parking at Geelong station is very heavily utilised. Please see Appendix **B** for details about the Geelong station parking surveys which were conducted over a period of two separate days. Some key observations from the surveys include:

- 96% to 99% of the no restriction car parking spaces were occupied through the morning peak period.
- By the commencement of the evening peak occupancy survey 85% to 88% of the no restriction parking spaces were occupied.
- Use of the disabled parking provisions varied with considerable fluctuation over the two survey days for both peak periods.

Of significant note was that during the morning survey period, the peak parking demands at the eastern and western Geelong carparks was surveyed to be 179 and 426 cars, respectively. Of the 179 cars arriving at the eastern carpark, the drivers of 93 (52 percent) did not proceed to enter the station. Of the 426 cars arriving at the western carpark, the drivers of 50 (12 percent) were not observed to have entered the station.

In the evening peak the percentages of drivers whose cars were parked at Geelong station but who did not appear to use the station itself increased to 68 percent and 33 percent for the eastern and western carparks, respectively.

2.4.3 Bicycle parking

Geelong station has capacity for a total of 62 bicycles split between loops (30), spirals (14), lockers (4) and a parkiteer cage (provides capacity for 12 loops and 14 hanging bikes).

Bicycle parking occupancy survey results for the morning and evening peak periods (Tuesday 5 June 2018) are shown in Table 13 and Table 14.

Table 13 Geelong station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys					
			6:00	7:00	8:00	9:00	9:30	
Formal bicycle parking	Loops	18	2	3	4	4	4	
	Spirals	14	4	5	8	8	9	
	Lockers	4	0	0	0	0	0	
	Parkiteer Cage	Loops	12	1	4	5	5	5
		Hanging	14	1	3	3	3	3
	Total		62	8	15	20	20	21
% Occupancy			13%	27%	32%	32%	34%	
Informal bicycle parking			0	0	0	0	0	

Table 14 Geelong station – Supply and demand for bicycle parking, PM peak

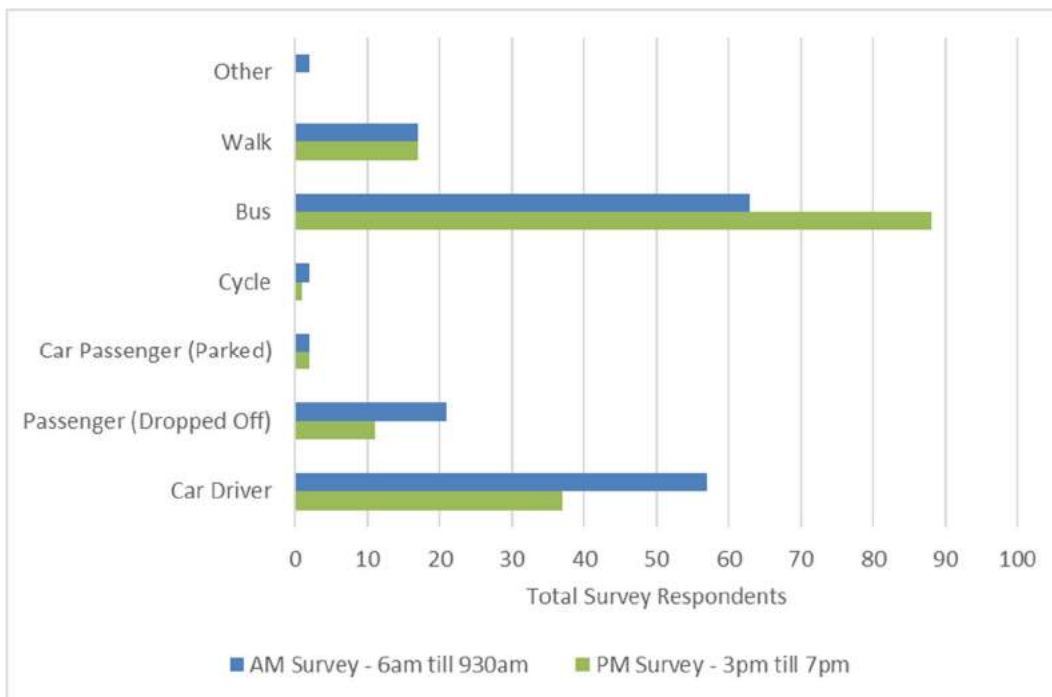
Bicycle parking		Supply	Evening surveys					
			15:00	16:00	17:00	18:00	19:00	
Formal bicycle parking	Loops	18	4	3	2	1	0	
	Spirals	14	10	9	6	6	5	
	Lockers	4	0	0	0	0	0	
	Parkiteer Cage	Loops	12	5	6	6	4	1
		Hanging	14	3	3	3	2	2
	Total		62	22	21	15	13	8
% Occupancy			35%	34%	27%	21%	13%	
Informal bicycle parking			0	0	0	0	0	

As shown from Table 13 and Table 14 there is sufficient bicycle parking capacity at Geelong Station to cater to existing demand, with a peak bicycle parking occupancy of 35 percent.

2.4.4 Mode share

The mode choice by the survey respondents on how they travelled to Geelong Station is shown in Figure 16.

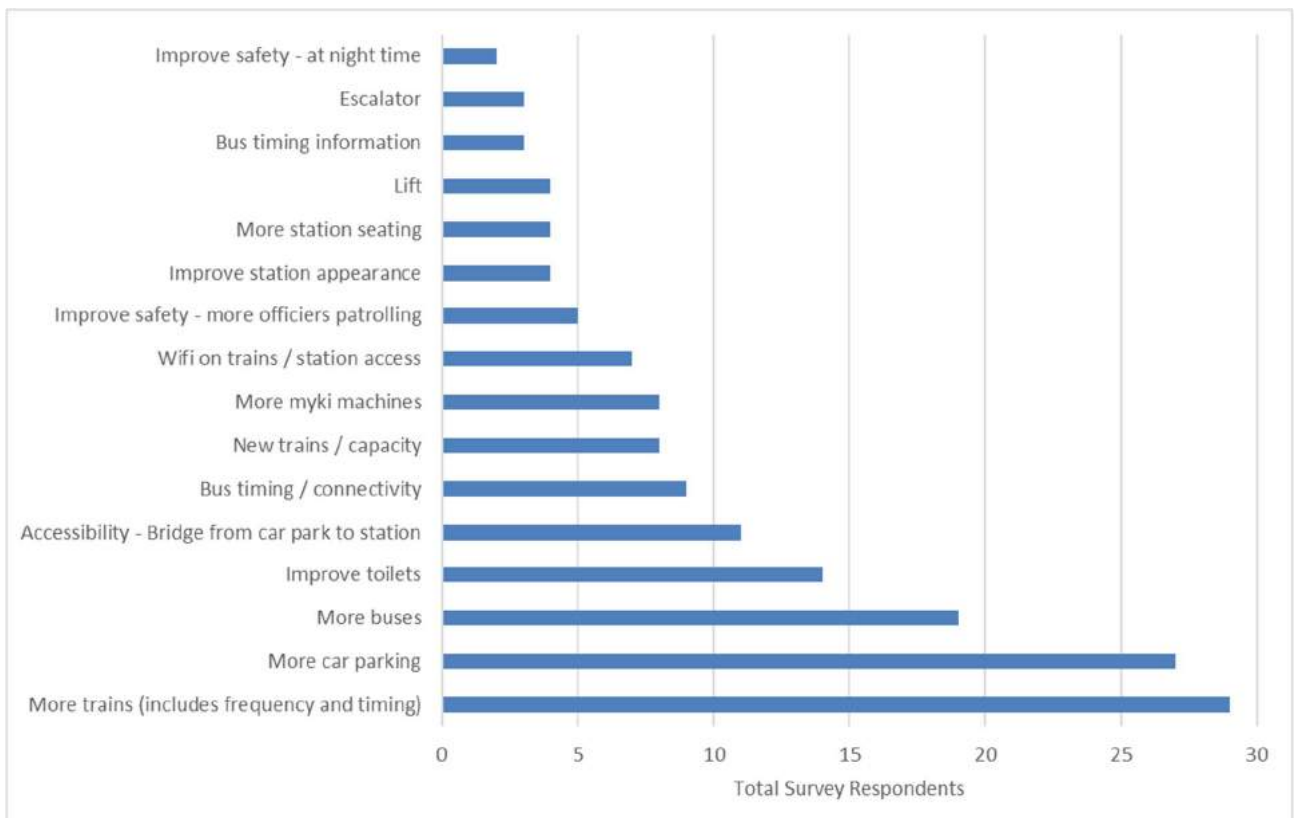
Figure 16 Geelong station – commuter modes



2.4.5 Customer suggested improvements

Geelong Station commuters were asked what suggested improvements they would prioritise for the station or its transport links. A summary of the most frequent responses is provided in Figure 7.

Figure 17 Geelong station – suggested improvements



2.5 South Geelong station

The existing conditions at South Geelong station are summarised in Table 15.

Table 15 Existing conditions – South Geelong station

Item		Description
Station Accessibility	Services	South Geelong station consists of a single platform which provides V/Line services to Marshall, Waurm Ponds, Southern Cross and Warrnambool. The station has a station building and is staffed part time.
	Platform Access	Five access points onto the platform (one through the station building, three via the carpark and one via Yarra Street)
	Vehicle Access	The station carpark can be accessed via crossovers provided on Yarra Street (entry only implied although no formal signage) and Verner Street (two all movement accesses and a single exit).
	Walking	All local streets have footpaths provided.
	Cycling	Shared use path along Carr Street and Lonsdale Street. Bicycle lanes along Yarra Street and Swanston Street.
	Bus	Serviced by bus routes 1 and 101
Station Facilities	Car parking	553 off-street carparking spaces (includes eight disabled bays) and five authorised V/line parking only spaces. The sealing of 200 gravel car parking spaces will be complete by mid December 2018.
	Bus facilities	Three VLine bus replacement bus stops located internally, however no public bus stops. Bus stop located on Yarra Street in direct vicinity to station. Skybus stop present on Yarra Street.
	Kiss and Ride	Five 10-minute bays in immediate proximity of the station building
	Bicycle facilities	Bicycle loops with capacity for 36 bicycles. A Parkiteer Cage is present which caters for a total of 26 bicycles (12 loops and 14 hanging)
	Taxi facilities	Five taxi bays provided.
	Wheelchair accessible	Yes. Ramp to access platform and toilets.
	Tactile paths	Yes
	Hearing loop	No
On-street carparking	Foster Street provides 254 parking spaces with a mixture of unrestricted and 4P restrictions. Bellerine Street provides 107 parking spaces with a mixture of unrestricted, 2P and 4P restrictions. Yarra Street provides 67 parking spaces with a mixture of unrestricted, 2P and 4P restrictions. Verner Street provides 104 parking spaces with a mixture of unrestricted, 1/4P, 1P, 2P and 4P restrictions. Lonsdale Street provides 138 parking spaces with a mixture of 1/2P, 1P, 2P and 4P restrictions. Carr Street provides 190 parking spaces which are unrestricted. Mundy Street provides 123 parking spaces which are unrestricted.	

2.5.1 Car parking

A total of 558 off-street carparking spaces were recorded at South Geelong station. These consist of:

- 545 car parking spaces with no restrictions
- Five 10-minute kiss and ride spaces
- Eight disabled spaces.

The occupancy survey results of the off-street carpark for the morning and evening peak periods are shown in Figure 18 and Figure 19, in comparison with the generally accepted 85 percent capacity benchmark.

Figure 18 South Geelong station off-street car parking occupancy – morning peak period (6.00-9.30 am)

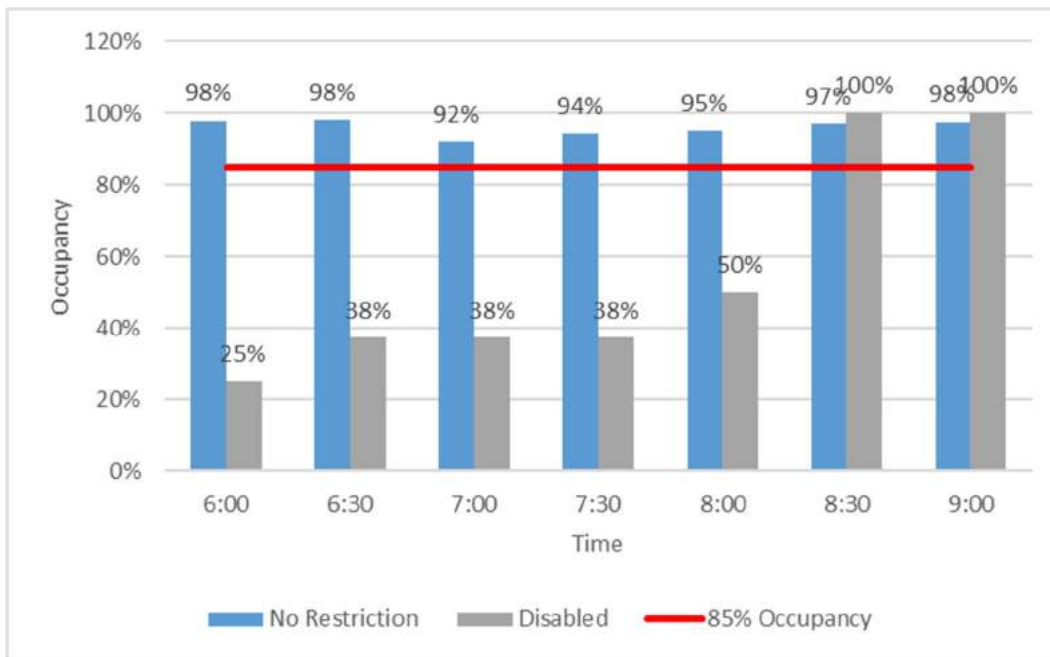
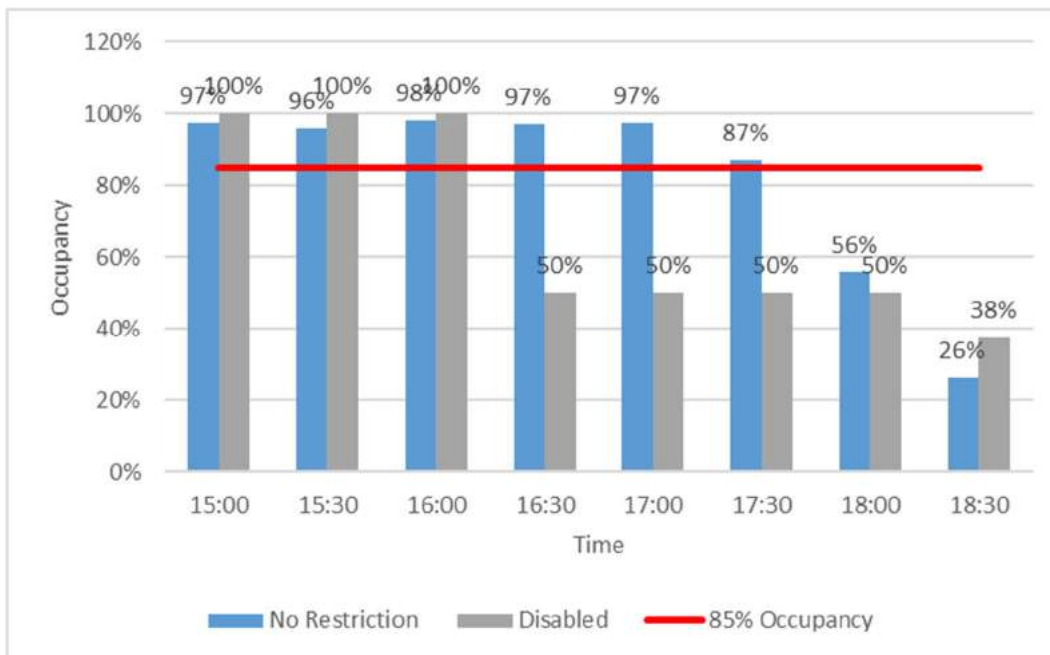
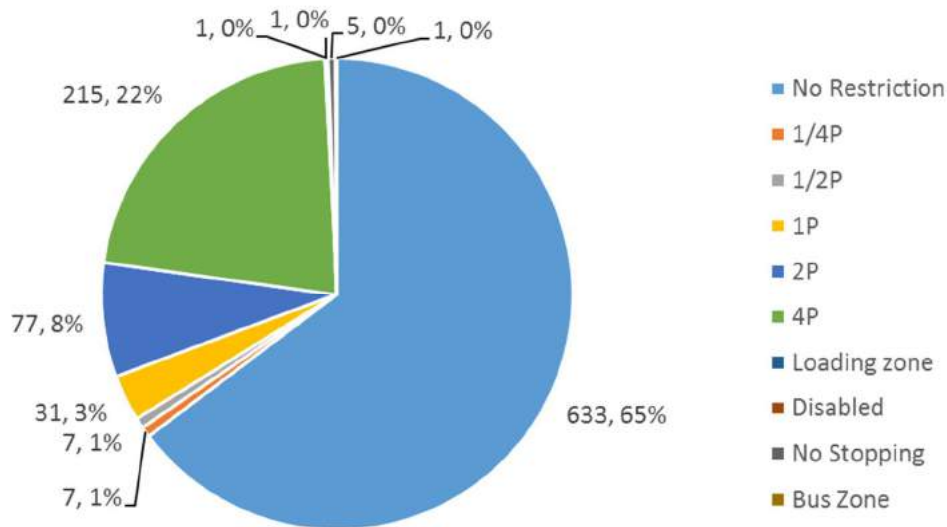


Figure 19 South Geelong station off-street car parking occupancy – evening peak period (3.00-7.00 pm)



A total of 978 on-street car parking spaces were also surveyed near South Geelong station. The extents of the survey and restrictions in place are shown in Figure 20. Most of the on-street parking spaces are unrestricted (633), with timed parking spaces ranging from 4P (215), 2P (77) and 1P (31).

Figure 20 South Geelong station – On-street car parking restrictions overview



The occupancy survey results of the on-street car parking near South Geelong station for the morning and evening survey periods are shown in Figure 21 and Figure 22.

Figure 21 South Geelong station on-street car parking occupancy – morning survey period (6.00-9.30 am)

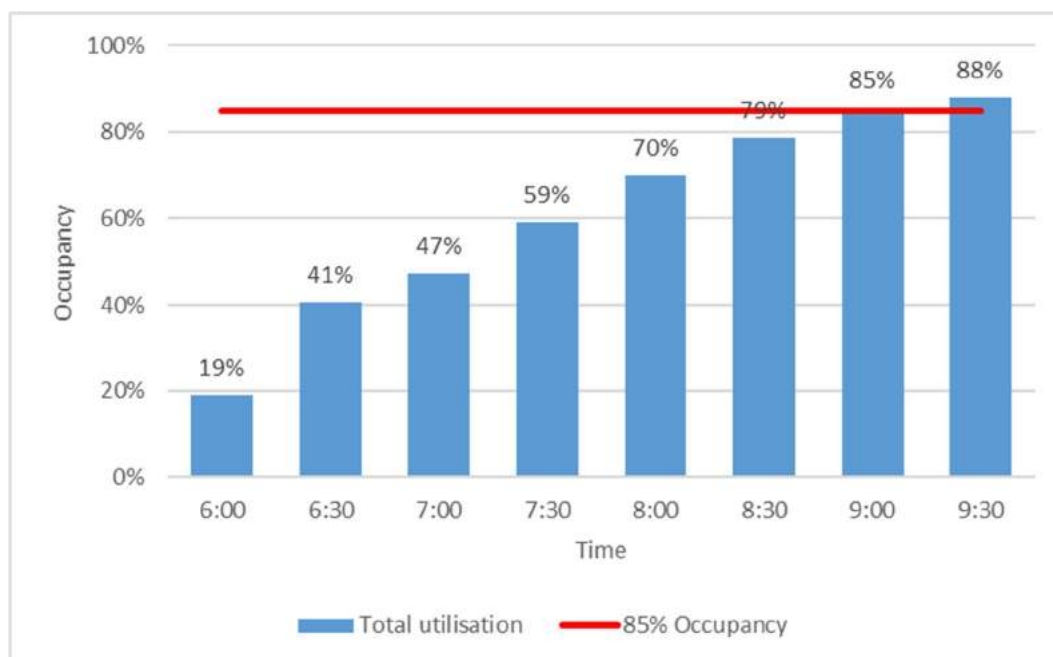
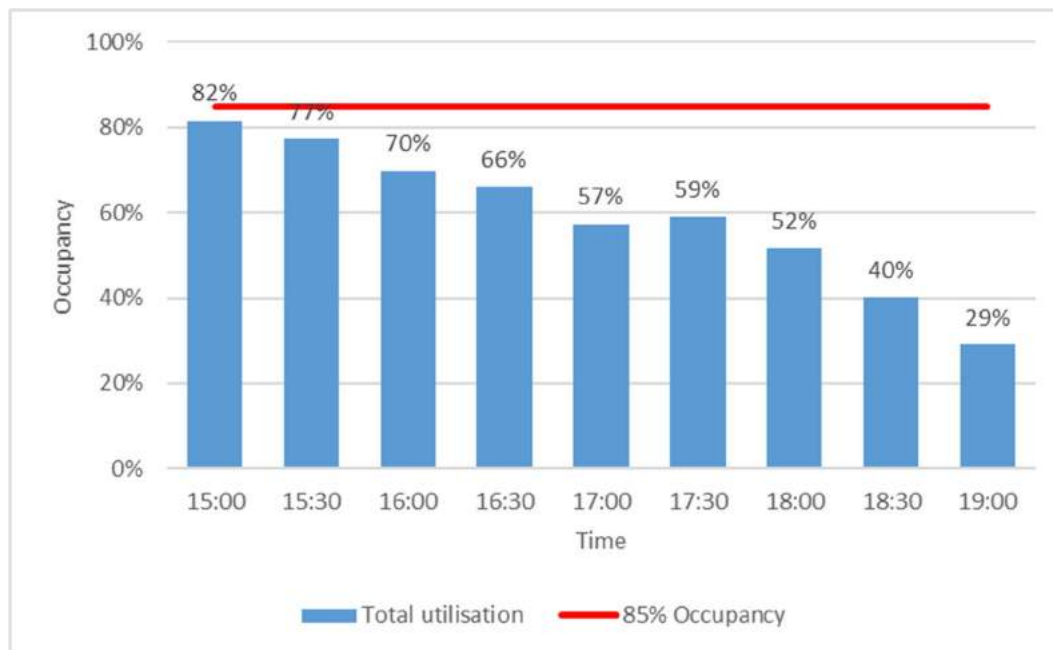


Figure 22 South Geelong station on-street car parking occupancy – evening survey period (3.00-7.00 pm)



2.5.2 Bicycle parking

South Geelong station has capacity for a total of 62 bicycles split between loops (36) and a parkiteer cage (which provides 12 additional loops and 14 hanging spaces for bicycles).

Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 16 and Table 17.

Table 16 South Geelong station – Supply and demand bicycle parking, AM peak

Bicycle parking			Supply	Morning surveys				
				6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops		36	2	3	4	5	5
	Parkiteer Cage	Loops	12	2	6	9	9	9
		Hanging	14	4	7	9	10	10
	Total		62	8	16	22	24	24
	% Occupancy				13%	26%	35%	39%
Informal bicycle parking				0	0	0	0	0

Table 17 South Geelong station – Supply and demand bicycle parking, PM peak

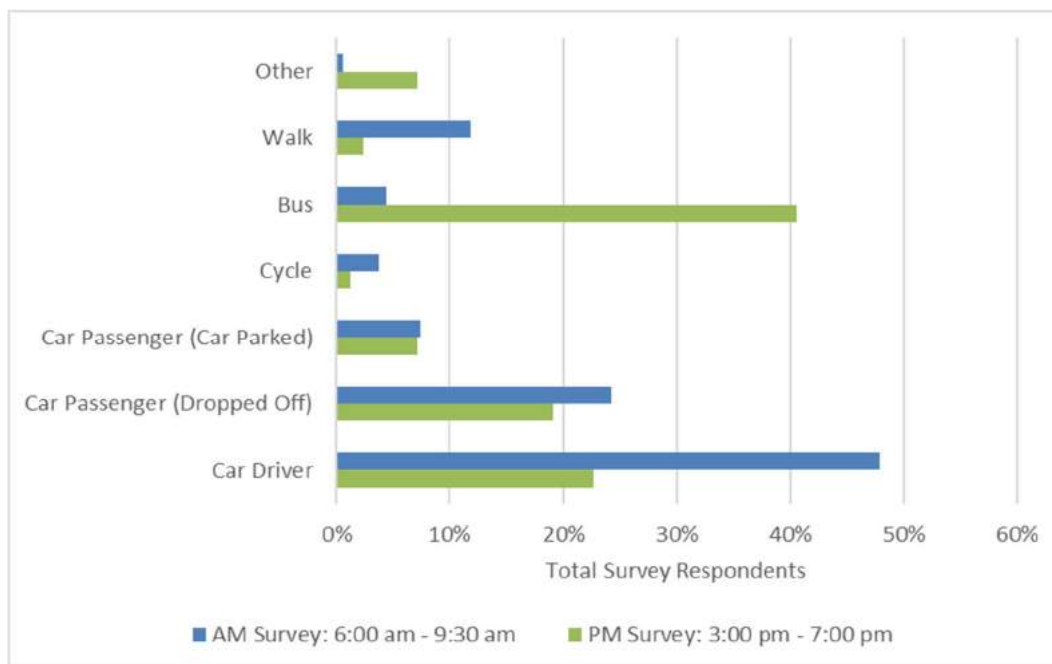
Bicycle parking			Supply	Evening surveys				
				15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops		36	7	5	4	4	3
	Parkiteer Cage	Loops	12	8	8	8	4	2
		Hanging	14	10	10	10	9	1
	Total		62	25	23	22	17	6
	% Occupancy				40%	37%	35%	27%
Informal bicycle parking				0	0	0	0	0

As shown from Table 16 and Table 17 there is ample bicycle parking capacity at South Geelong station for the current observed demand, with a peak bicycle parking occupancy of 40 percent.

2.5.3 Mode share

The mode choice by the survey respondents on how they travelled to South Geelong station is shown in Figure 23.

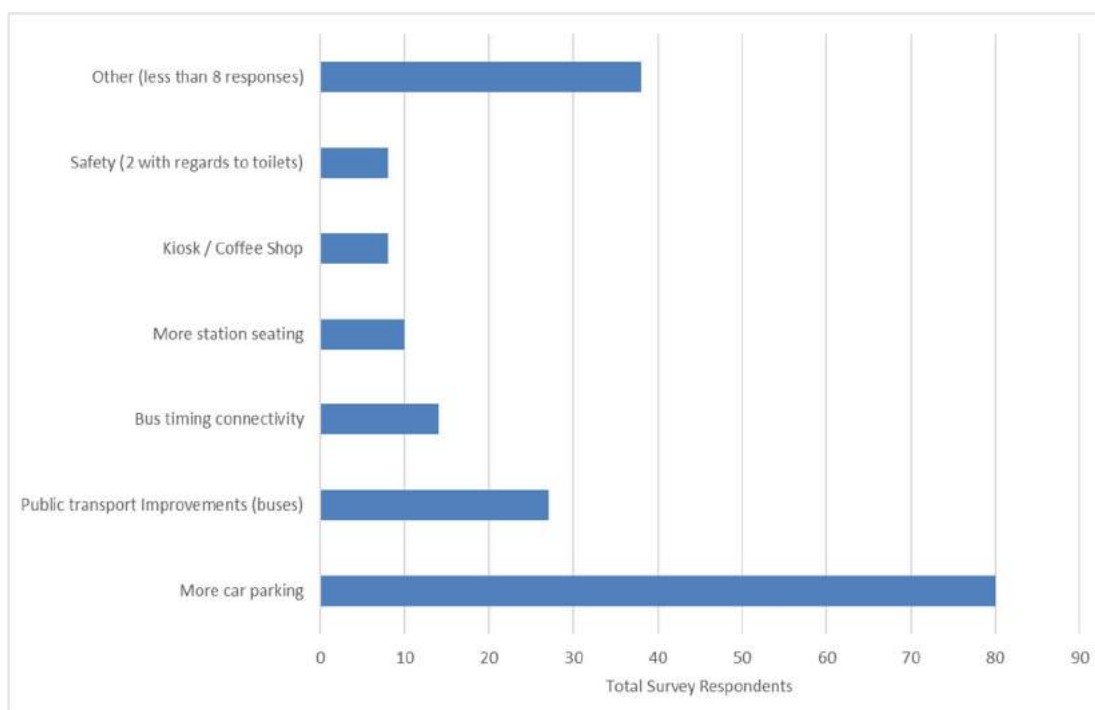
Figure 23 South Geelong station – commuter modes



2.5.4 Customer suggested improvements

South Geelong commuters were asked what suggested improvements they would prioritise for either the station or its transport links. A summary of the most frequent responses is provided in Figure 7.

Figure 24 South Geelong station – suggested improvements



2.6 Marshall station

2.6.1 Overview

The existing conditions at Marshall station are summarised in Table 18.

Table 18 Existing conditions – Marshall station

Item		Description
Station Accessibility	Services	Marshall station consists of a single platform which provides V/Line services to Wauran Ponds, Southern Cross and Warrnambool. The station has a station building and is staffed part time.
	Platform Access	Two access points onto the platform
	Vehicle Access	Station accessed via a priority intersection with Marshalltown Road. The access is located approximately 20m east of the Marshalltown Road level crossing.
	Walking	All local streets have footpaths provided. A dedicated pedestrian path is provided to the along the eastern side of the rail line.
	Cycling	No bicycle infrastructure in the immediate area. Marshall Town Road and Drews Road are part of the PBN.
	Bus	Serviced by bus routes 40, 50, 51 and 55
Station Facilities	Car parking	A total of 455 car parking spaces are provided, with 433 having no restrictions (of which approximately 55 spaces are provided on an informal gravel parking area). There are 12 kiss and ride spaces and seven disabled parking bays provided.
	Bus facilities	Bus stop is provided directly opposite the station with 3 bus bays provided.
	Kiss and Ride	Two two-minute and 10 10-minute bays provided in the immediate proximity of the station.
	Bicycle facilities	Bicycle loops with capacity for three bicycles. A Parkiteer Cage is present with capacity for 26 bicycles (12 loops and 14 hanging).
	Taxi facilities	One taxi bay
	Wheelchair accessible	Yes. Ramp to access platform
	Tactile paths	Yes
	Hearing loop	Yes
On-street carparking		No associated on-street parking

2.6.2 Car parking

A total of 397 off-street carparking spaces were recorded at Marshall station. These consist of:

- 378 car parking spaces with no restrictions
- 12 kiss and ride spaces, including ten 10-minute spaces and two 2-minute spaces
- 14 disabled spaces.

In addition, it was observed that an informal gravel area for parking was provided to the east of the southern car parking area. The parking capacity in this area was observed on site to cater for approximately 55 cars.

The occupancy survey results for the off-street carpark for the morning and evening peak periods are shown in Figure 25 and Figure 26, in comparison with the generally accepted 85 percent benchmark.

Figure 25 Marshall station off-street car parking occupancy – morning peak period (6.00-9.30 am)

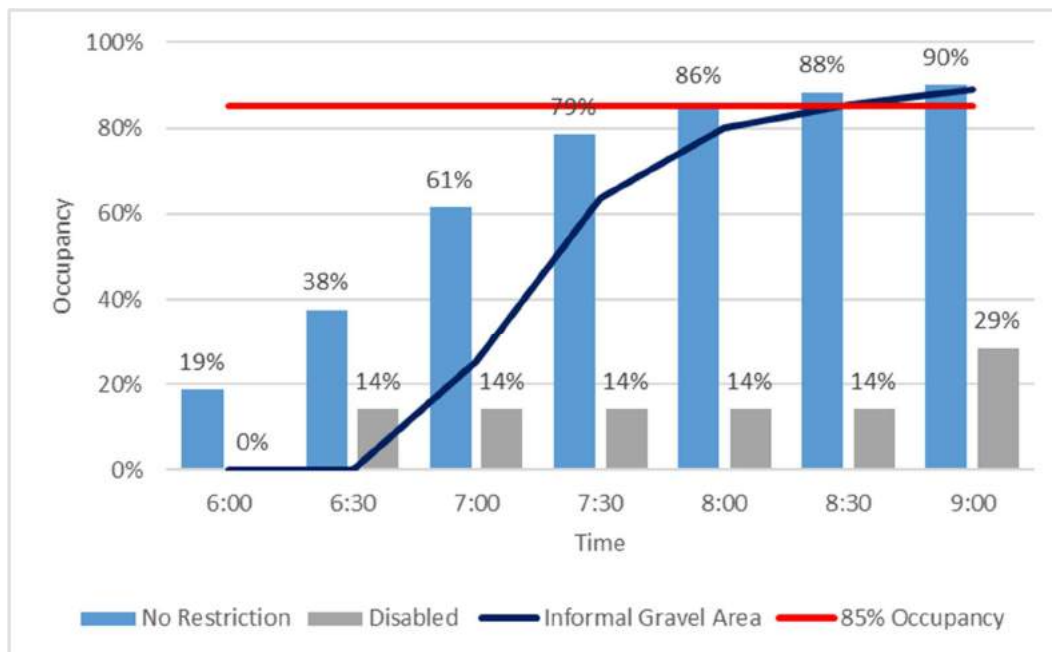
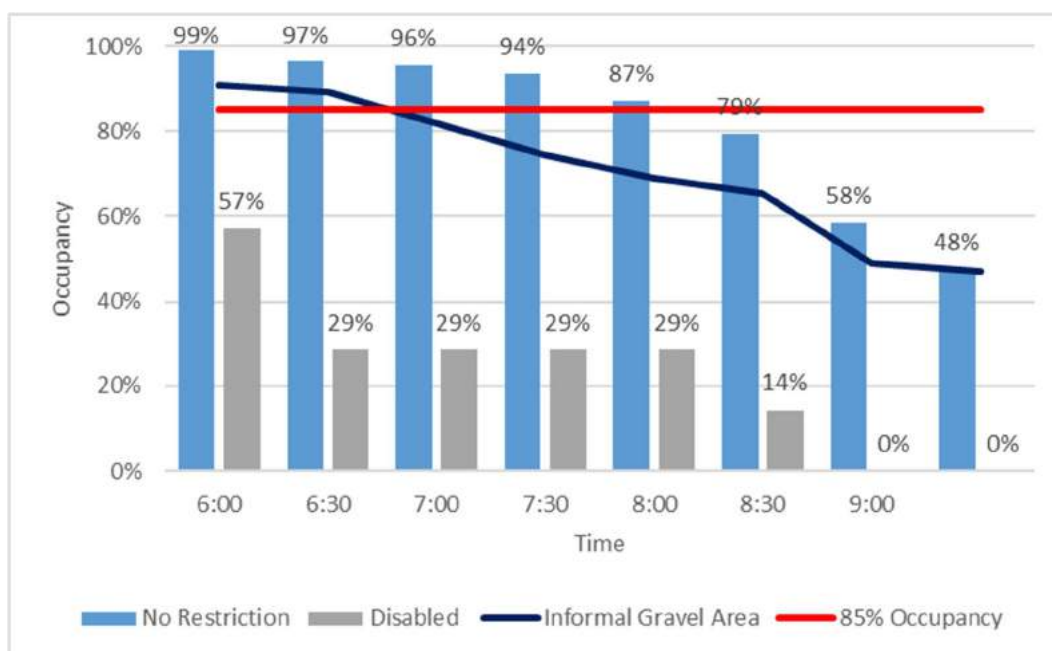


Figure 26 Marshall station off-street car parking occupancy – evening peak period (3.00- 7.00 pm)



It can be noted from Figure 25 that the informal gravel area was being utilised for parking before the formal car parking area was full.

2.6.3 Bicycle parking

Marshall station has capacity for a total of 29 bicycles split between loops (3) and a parkiteer cage (which provides 12 loops and 14 hanging spaces for bicycles).

Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 19 and Table 20.

Table 19 Marshall station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	3	1	2	2	3	3
	Parkiteer Cage	Loops	12	0	1	1	1
		Hanging	14	1	2	2	2
	Total	29	2	5	5	6	6
	% Occupancy			7%	17%	17%	21%
Informal bicycle parking			0	0	0	0	0

Table 20 Marshall station – Supply and demand bicycle parking, PM peak

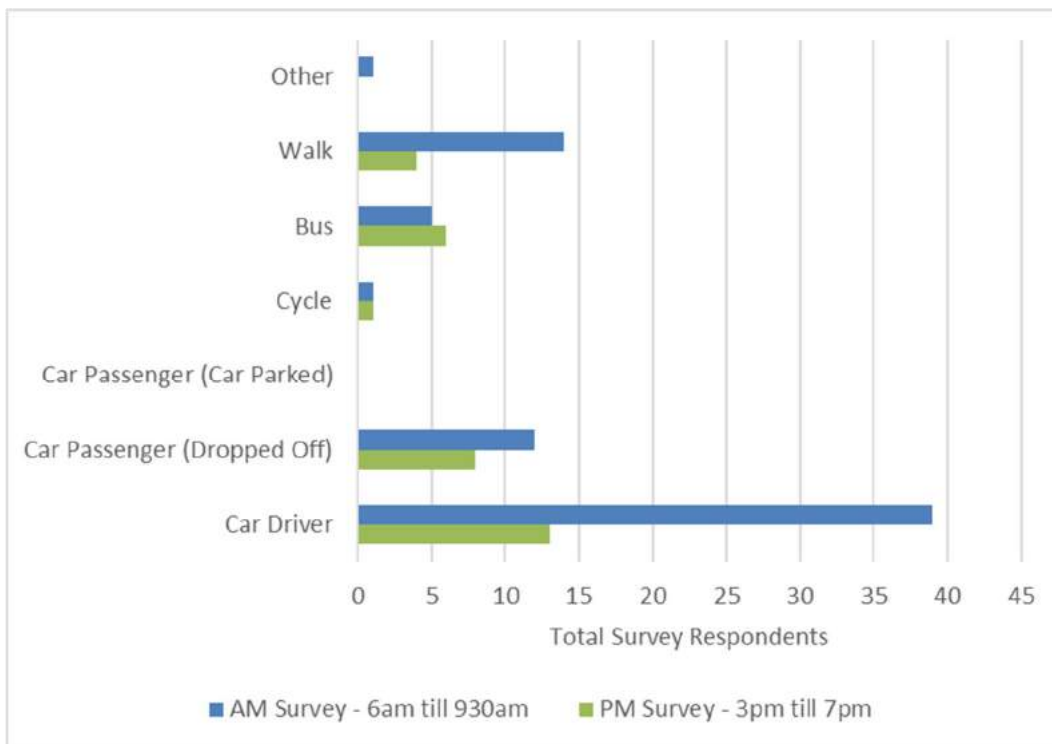
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	3	4	4	4	4	4
	Parkiteer Cage	Loops	12	1	1	1	0
		Hanging	14	3	3	3	3
	Total	29	8	8	8	7	6
	% Occupancy			28%	28%	28%	24%
Informal bicycle parking			0	0	0	0	0

As shown from Table 19 and Table 20 there is sufficient bicycle parking capacity at Marshall station to meet existing demand, with a peak bicycle parking occupancy of 28 percent.

2.6.4 Mode share

The mode choice by the survey respondents on how they travelled to Marshall station is shown in Figure 27.

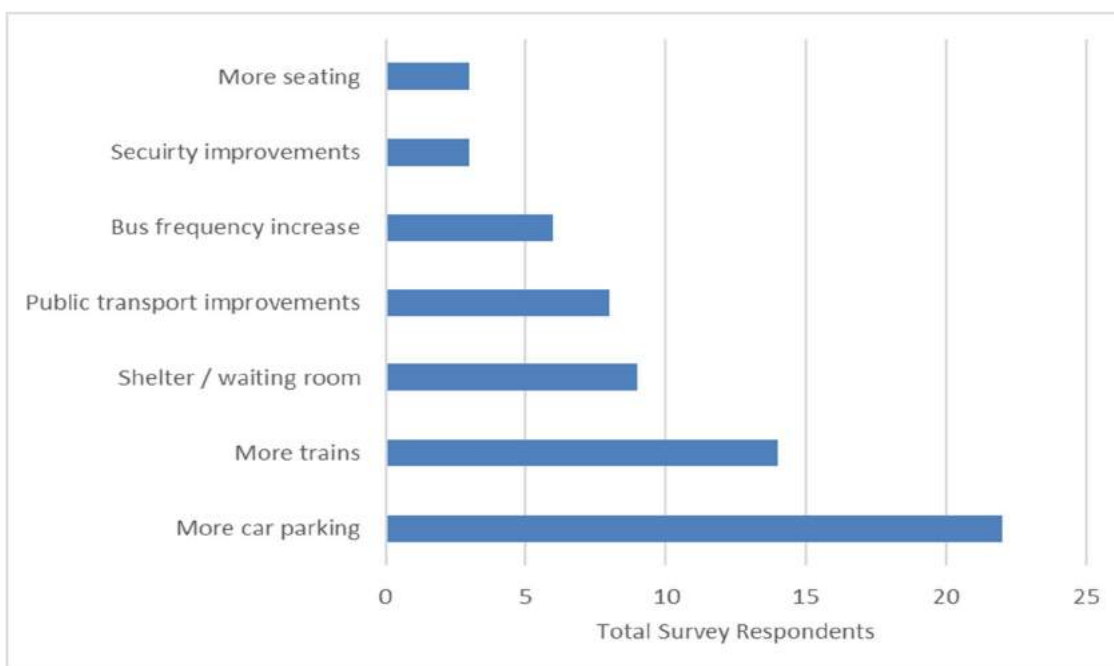
Figure 27 Marshall station – commuter modes



2.6.5 Customer suggested improvements

Marshall station commuters were asked what suggested improvements they would prioritise for the station or its transport links. A summary of the most frequently occurring responses is provided in Figure 7.

Figure 28 Marshall station – suggested improvements



2.7 Waurm Ponds station

The existing conditions at Waurm Ponds station are summarised in Table 21.

Table 21 Existing conditions – Waurm Ponds station

Item		Description
Station Accessibility	Services	Waurm Ponds station consists of a single platform which provides V/Line services to Southern Cross and Warrnambool. The station has a station building and is staffed.
	Platform Access	Four access points onto the platform (one via the station building and three via the carpark)
	Vehicle Access	The station carpark is accessed via the Sugargum Drive / Bodega Street roundabout.
	Walking	All local streets have footpaths provided, with those locally to the station offset by grassed verge from the road. Zebra crossings are provided across Sugargum Drive for access to and from the provided bus stops.
	Cycling	No bicycle infrastructure in the immediate area. Bodega Street is part of the PBN.
	Bus	Serviced by bus routes 41 and 42
Station Facilities	Car parking	A total of 301 car parking spaces are provided, which include 279 spaces with no restrictions, seven kiss and ride spaces, five disabled, four motorcycle spaces and the remainder being a mixture of permit and no stopping (authorised vehicles excepted) spaces. VicTrack recently completed the formalising of 50 gravel car parking spaces.
	Bus facilities	Bus stops are provided directly opposite the station on Sugargum Drive.
	Kiss and Ride	Two two-minute and three five-minute bays provided in immediate proximity of the station.
	Bicycle facilities	Bicycle spirals with capacity for nine bicycles. A Parkiteer Cage is present with capacity for 21 bicycles (6 loops and 15 hanging).
	Taxi facilities	None
	Wheelchair accessible	Yes. Platform at-grade
	Tactile paths	Yes
	Hearing loop	No
On-street carparking		No associated on-street parking

2.7.1 Car parking

A total of 291 off-street carparking spaces were recorded for Waurm Ponds station. These consist of:

- 279 car parking spaces with no restrictions
- Seven kiss and ride spaces (consisting of four 2-minute and three 5-minute time limited spaces)
- Five disabled spaces.

In addition, it was observed that the gravel area to the east of the off-street carpark is used informally by commuters. The parking capacity in this area was observed on site to cater for approximately 89 cars.

The occupancy survey results of the off-street carpark for the morning and evening peak periods are shown in Figure 29 and Figure 30, in comparison with the generally accepted 85 percent capacity benchmark.

Figure 29 Waurn Ponds station off-street car parking occupancy – morning peak period (6.00-9.30 am)

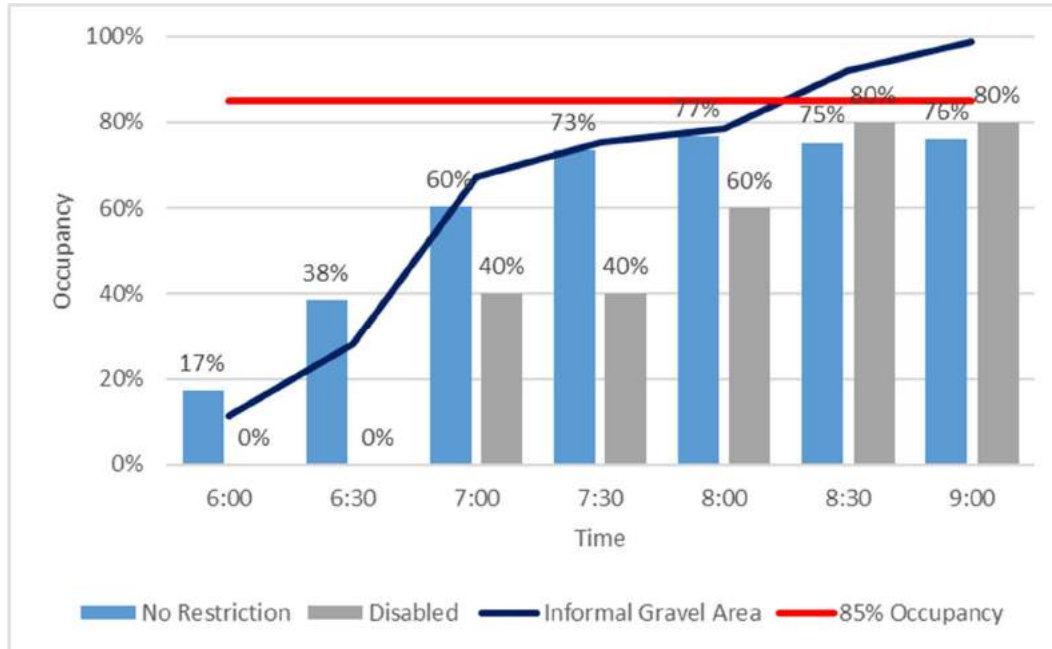
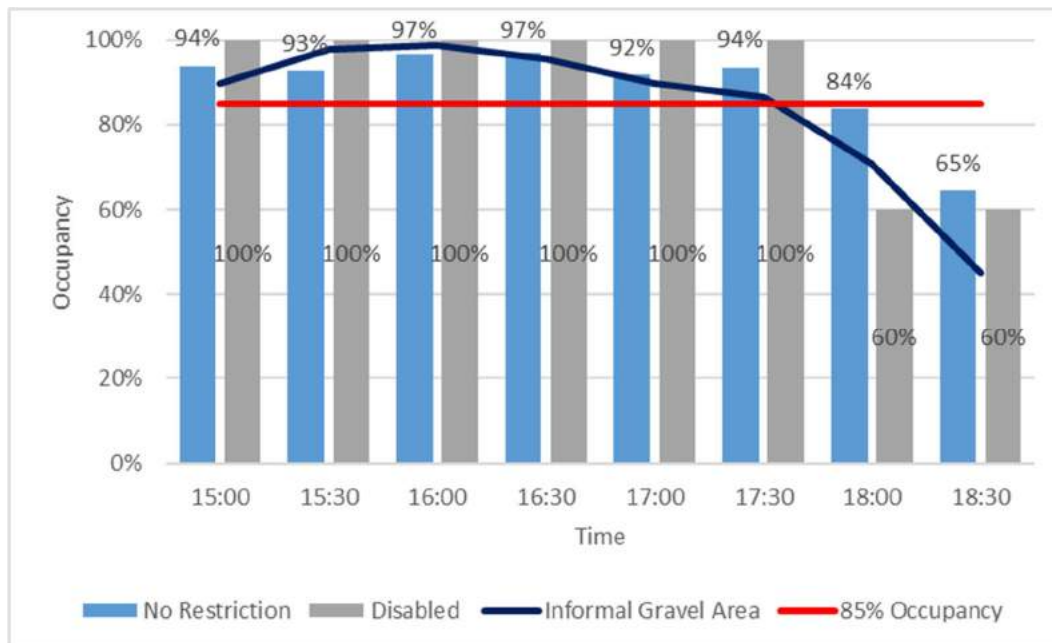


Figure 30 Waurn Ponds station off-street car parking occupancy – evening peak period (3.00-7.00 pm)



The informal gravel area was being utilised for parking before the formal car parking area was nearing capacity, most likely due to this area being more prominent to drivers accessing the area from the east and parking in the nearest available spaces. The gravel parking area was 89 percent full at 9.00 am and 4.00 pm during the undertaken surveys.

2.7.2 Bicycle parking

Waurm Ponds station has capacity for a total of 30 bicycles split between spirals (9) and a parkiteer cage which provides 6 loops and 15 hanging spaces for bicycles.

Bicycle parking occupancy survey results for the morning and evening peak periods are shown in Table 22 and Table 23.

Table 22 Waurm Ponds station – Supply and demand for bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys					
			6:00	7:00	8:00	9:00	9:30	
Formal bicycle parking	Spirals		9	2	2	3	4	4
	Parkiteer Cage	Loops	6	0	0	1	1	1
		Hanging	15	3	4	6	7	7
	Total		30	3	4	6	7	7
	% Occupancy			10%	13%	20%	23%	23%
Informal bicycle parking			0	0	0	0	0	

Table 23 Waurm Ponds station – Supply and demand for bicycle parking, PM peak

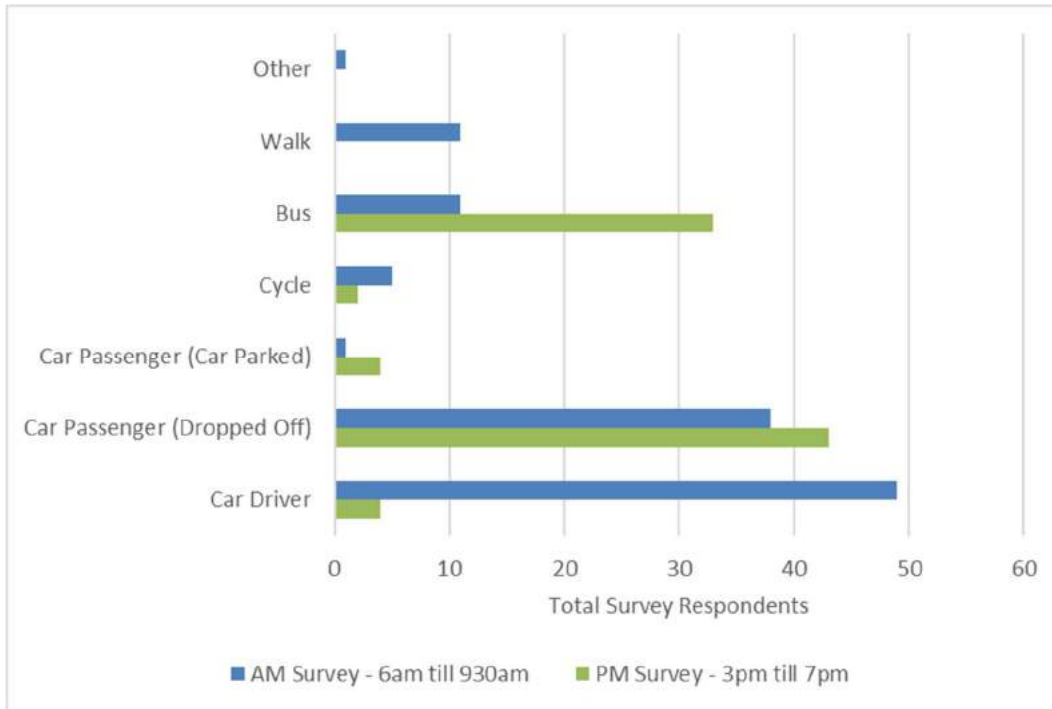
Bicycle parking		Supply	Evening surveys					
			15:00	16:00	17:00	18:00	19:00	
Formal bicycle parking	Spirals		9	4	5	5	3	3
	Parkiteer Cage	Loops	6	1	1	1	1	1
		Hanging	15	2	2	2	0	0
	Total		30	7	8	8	4	4
	% Occupancy			23%	27%	27%	13%	13%
Informal bicycle parking			0	0	0	0	0	

As shown from Table 22 and Table 23, there is sufficient bicycle parking capacity at Waurm Ponds station to meet current demand, with a peak bicycle parking occupancy of 27 percent.

2.7.3 Mode share

The mode choice by the survey respondents on how they travelled to Waurn Ponds Station is shown in Figure 31.

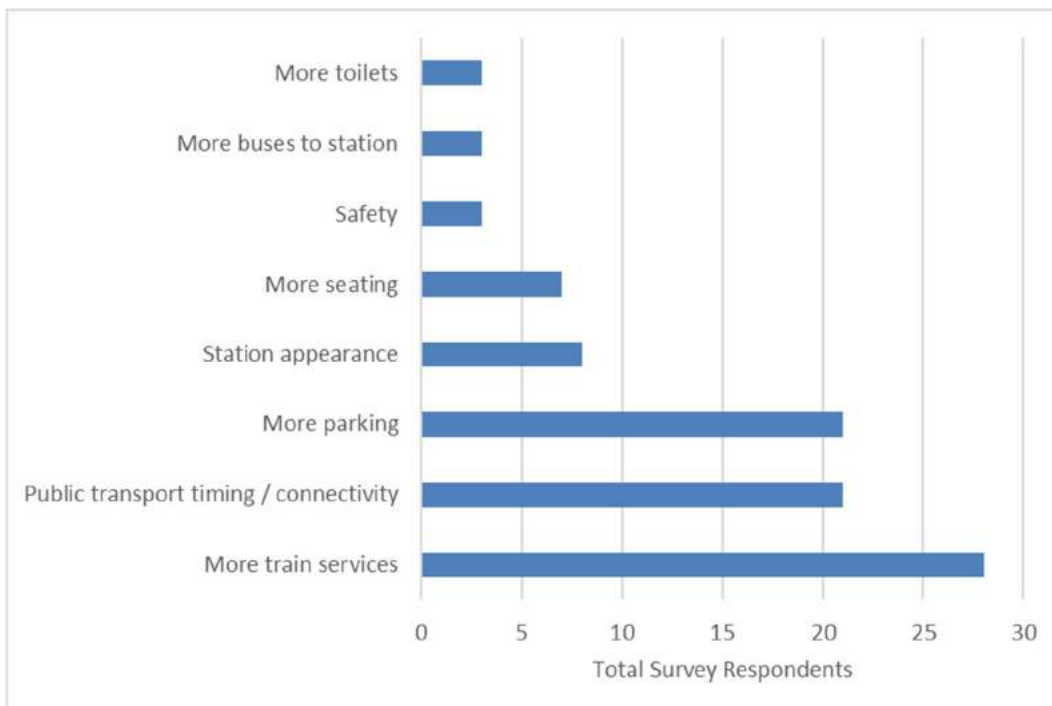
Figure 31 Waurn Ponds station – commuter modes



2.7.4 Customer suggested improvements

Waurn Ponds station commuters were asked what suggested improvements they would prioritise for the station or its transport links. A summary of the most frequent responses is provided in Figure 32.

Figure 32 Waurn Ponds station – suggested improvements



2.8 Undeveloped land

A summary of the undeveloped land review at each of the study stations is provided in Table 24. Planning overlays, zoning maps and VicTrack land boundaries for the study stations are provided in Appendix C.

Table 24 Undeveloped land summary

Station	Land review	Land for future commuter parking
Lara	VicTrack land boundary extends to the north-east of the existing station / parking area and is currently vacant. The area is zoned PUZ4 public use transport. No flooding overlays are present.	The most suitable land to be used for future car parking is immediately to the north-east of the existing carpark. This is VicTrack land and would not require any re-zoning.
North Shore	VicTrack land boundary is constrained with some land available abutting the rail line to the west and an area of land which is leased on the eastern side of the rail corridor. The area is zoned PUZ4 public use transport. No flooding overlays are present.	The most suitable land to be used for future car parking is immediately north of the existing carpark which is vacant VicTrack land and requires no rezoning.
North Geelong	VicTrack land boundary extends to the north of the existing North Geelong parking area on the western side of the rail corridor. The area is zoned PUZ4 public use transport. No flooding overlays are present.	Most suitable land to be used for future carparking is to formalise the car park to the north or use the vacant Department of Finance and Treasury land. The vacant DFT land is the previous "North Geelong Gasworks" and currently is contaminated land which is vacant and unused. DFT are looking to repurpose this land.
Geelong	VicTrack land boundary is constrained. No flooding overlays are present.	The objective of this study is to reduce commuter car parking at Geelong station over time.
South Geelong	The VicTrack land boundary is constrained. Vacant land to the south of the existing recently sealed car park is classified EAO (environmental audit) in the planning overlay. No flooding overlays are present.	The most suitable land to be used for future carparking is the land with EAO to the south of the existing gravel carpark. Otherwise the Barwon Water Land is undergoing rezoning. However, the South Geelong to Waurn Ponds rail study and the Urban Design Framework for South Geelong station could further inform options to accommodate future parking demand.
Marshall	The VicTrack land boundary extends over a large parcel of land to the south and east of the existing southern car park. The zoning of land does not seem correct according to the footprint of the car park, the vacant land is designated UGZ – Urban Growth, however some of this land has already been developed on for station car parking. No flooding overlays are present.	The most suitable land to be used for future carparking is to the east, west or south of the existing southern carpark as this land is owned by VicTrack, however it is zoned as UGZ – Urban Growth so verification of future development will be required.
Waurn Ponds	VicTrack land boundary extends further east of the existing car park up to the Bodega Street roundabout.	The most suitable land to be used for future carparking is to the east of the existing carpark as this is VicTrack land and requires no rezoning.

2.9 Planned development

A review of planned development in the vicinity of the study stations has been conducted with a summary of this assessment provided in Table 25.

Table 25 Planned development summary

Station	Planned development
Lara	The Lara Structure Plan April 2011 noted the potential to develop an intermodal transport facility on the privately-owned site at the north-east end of Lara, which is located north-west adjacent to the Station. A pedestrian overpass with lifts was also proposed.
North Shore	RNDP – North Shore station additional bus shelter and associated lighting to be completed by the end of November 2018
North Geelong	-
Geelong	Geelong Station Precinct Land Use and Development Strategy (underway): Redevelopment of Geelong Station, it is currently a draft only and yet to be formally considered. However, this plan includes the removal of long-term parking at Geelong station and a complete overhaul of the station's access and facilities. This commuter car parking study supports the intent of removing the commuter car parking at Geelong station and investigates options to accommodate the spillover car parking at the remaining railway stations. Bus and taxi shelter improvements and PID installation are underway and are expected to be completed by early December 2018 under the Vic Track Road and rail minor works program which was an outcome of the Regional Network Development Plan.
South Geelong	Waurm Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong. • Duplication of rail track between South Geelong and Waurm Ponds stations. • Shared path along the corridor between South Geelong and Waurm Ponds station. <p>Barwon Water Land Redevelopment (2018): Barwon Water are vacating a landholding situated to the north of South Geelong station and this land is to be re-zoned. A precinct plan for the area surrounding South Geelong station by City of Greater Geelong is currently underway. Barwon Water board does not support this land being used for additional carparking which has informed the option to build a car parking structure at this station to accommodate the redistributed commuter car parking from Geelong station.</p>
Marshall	Waurm Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong • Duplication of rail track between South Geelong and Waurm Ponds stations • Shared path along the corridor between South Geelong and Waurm Ponds station <p>VicTrack have formalised the gravel carpark present to the east of the existing formal carpark with 50 extra carparks and extended platform shelters at Marshall station.</p>
Waurm Ponds	Regional Rail Revival - Geelong Line Upgrade - an additional platform and pedestrian link at Waurm Ponds station as well as rail track to enable trains to pass each other (funded). Waurm Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong and Marshall • Duplication of rail track between South Geelong and Waurm Ponds stations • Shared path along the corridor between South Geelong and Waurm Ponds station.

3.0 Comparison of station usage patterns

This chapter compares the usage of each station at a corridor level as informed by the parking and customer surveys. Please see Appendix D for an expanded version of this evaluation with additional statistics.

3.1 Station usage

The usage patterns of the railway stations in the Geelong corridor are influenced by their respective proximity to a variety of land uses. A summary of the station gate surveys is provided as follows:

- Figure 33 – Total 13-hour survey time period, 6 am to 7 pm
- Figure 34 – Morning peak survey time period, 6 am to 9.30 am
- Figure 35 – Evening peak survey time period, 3 pm to 7 pm

Figure 33 Station gate surveys – 13-hour time period, 6.00 am–7.00 pm

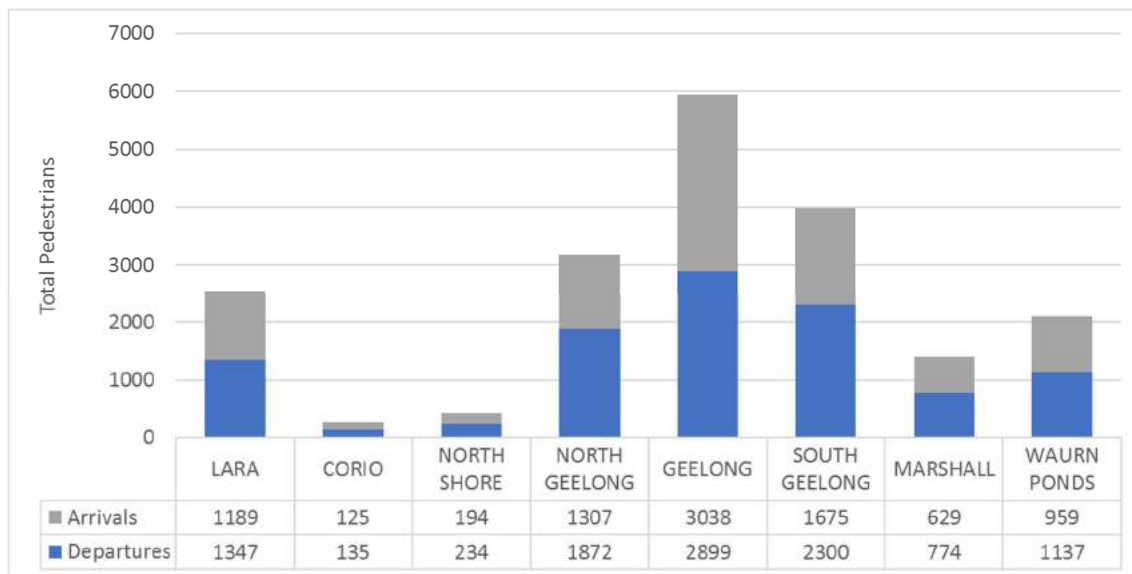


Figure 34 Station gate surveys – morning peak survey time period, 6.00-9.30 am

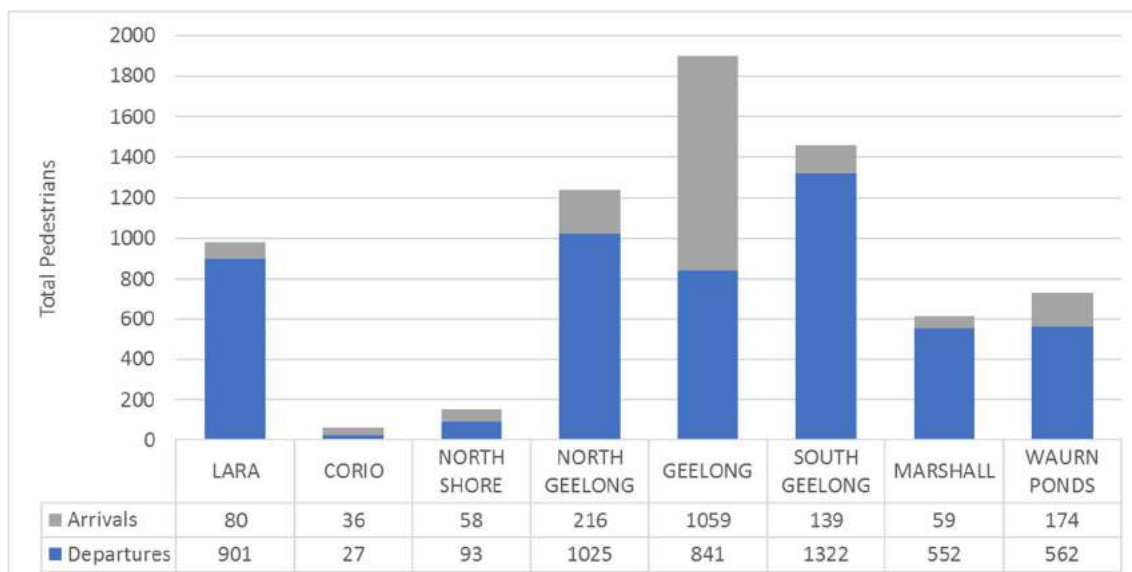
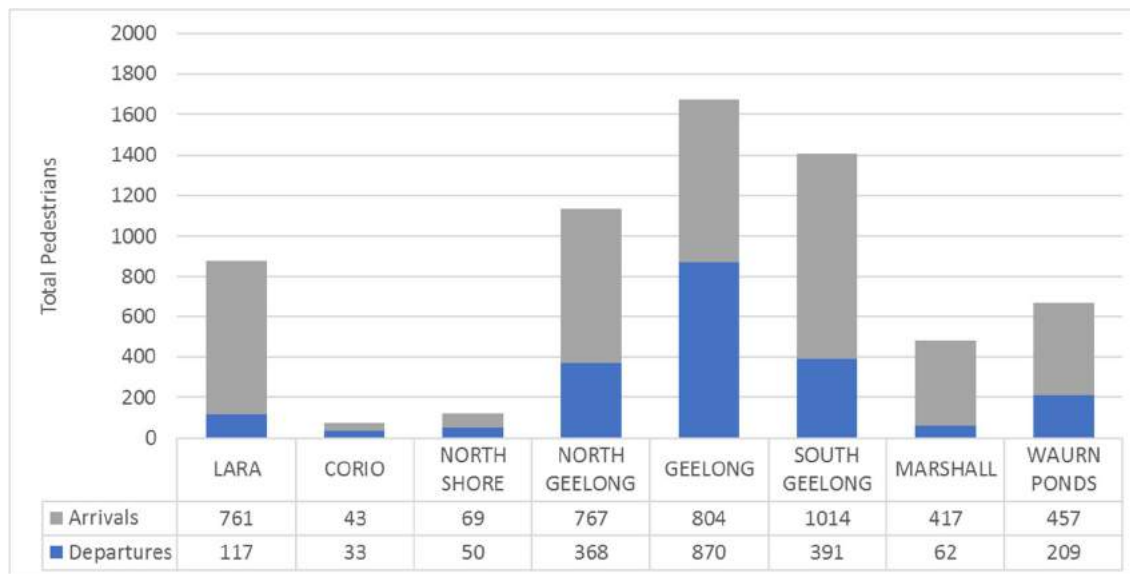


Figure 35 Station gate surveys – evening peak survey time period, 3.00-7.00 pm



As shown above, during the morning peak the majority of the observed commuters within the study area are boarding trains (i.e. ‘departing’ from the station) with only Geelong station differing from this trend as influenced by the local employment, retail and education land uses central Geelong.

During the evening peak the inverse trend occurs, with most passenger ‘arriving’ back at the stations mainly returning from work.

Overall the survey found that most commuters are travelling to and from work and educational purposes in the respective morning and evening survey periods, with those travelling for other reasons (likely recreational) increasing in the evening survey period.

3.2 Station mode shares

Appendix D provides a summary of the survey response with regards to mode of transport commuter used to their respective stations.

Figure 36 and Figure 37 summarise this data graphically for the morning and evening peak periods, respectively.

Figure 36 Mode shares – morning survey period (6.00-9.30 am)

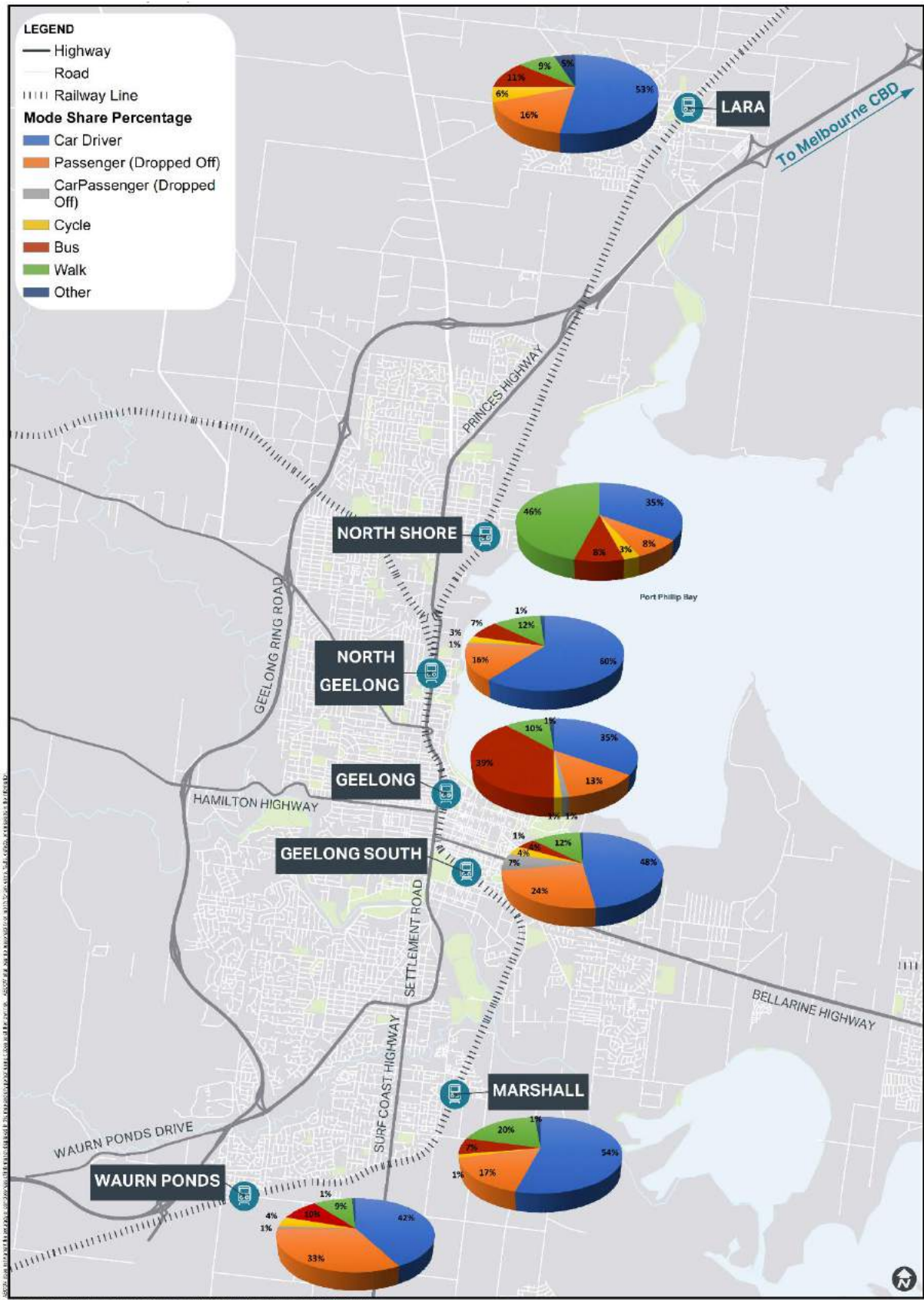
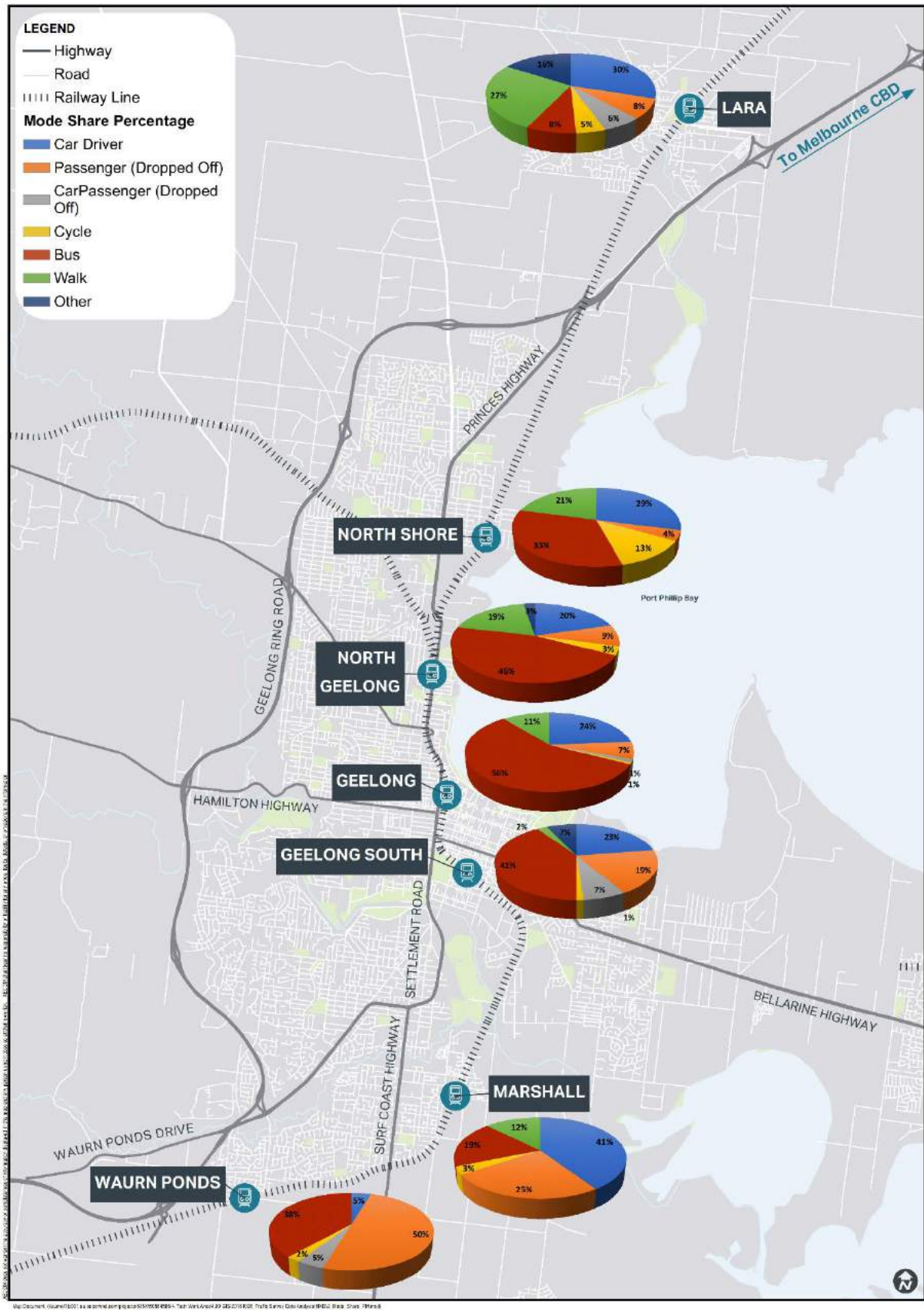


Figure 37 Mode shares – evening survey period (3.00-7.00 pm)



3.3 Commuter car parking demand

A summary of the station off-street car parking provisions and commuter demands are provided in Table 26 and Table 27 for the morning and evening peak demand periods.

As noted previously in this report, it is generally accepted by parking practitioners that 85 percent parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85 percent, it is generally more difficult for drivers to find available parking, resulting in undesirable practices such as excessive circulation or parking informally (at times in restricted areas). As shown from the survey results most of the stations along the Geelong corridor have exceeded their parking capacity. Other notable findings include:

- In the morning survey period a total of 53 patrons parked their cars at Geelong Station but were not commuters. This equates to approximately 9 percent of the available parking spaces being used by non-commuters in the morning survey period. In the evening survey period this total dropped to nine patrons or 2 percent of the available parking spaces.
- With the South Geelong off-street carpark being at capacity from 6 am, many commuters park on the surrounding streets. Based on the volume (859 of the 978, or 88 percent) filled by 9.30 am, it is reasonable to conclude that the vast majority of on-street parking can be attributed to commuters.

Table 26 Off-street station car parking supply and demand – morning peak demand time period – 9am

Station	Parking Supply	Parking Occupancy	Capacity %	Parking Remaining
Lara	585	552	94%	33
North Shore	63	21	33%	42
North Geelong	544	540	99%	4
Geelong	464	426	92%	38
South Geelong	545	532	98%	13
Marshall	433	390	90%	43
Waurm Ponds	368	300	82%	66
Totals	3,002	2,761	92%	241

Table 27 Off-street station car parking supply and demand – evening peak demand time period – 3pm

Station	Parking Supply	Parking Occupancy	Capacity %	Parking Remaining
Lara	585	558	95%	27
North Shore	63	23	37%	40
North Geelong	544	536	99%	8
Geelong	464	389	84%	75
South Geelong	545	530	97%	15
Marshall	433	424	98%	9
Waurm Ponds	368	342	93%	26
Totals	3,002	2,802	93%	200

During the surveys, observations were made to ascertain whether commuters were parking in the station carparks for reasons other than commuting (e.g. parking freely for work purposes). The results have demonstrated that this is a significant issue only at Geelong station.

During the morning survey period, the peak parking demands at the eastern and western Geelong station carparks was surveyed to be 179 and 426 cars, respectively. Of the 179 cars arriving at the eastern carpark, the drivers of 93 (52 percent) did not proceed to enter the station. Of the 426 cars arriving at the western carpark, the drivers of 50 (12 percent) were not observed to have entered the station.

In the evening peak the percentages of drivers whose cars were parked at Geelong station but who did not appear to use the station itself increased to 68 percent and 33 percent for the eastern and western carparks, respectively.

3.4 Car parking location

Appendix D outlines the results of the survey with respect to the percentages of passengers who parked on-street versus off-street upon arrival at each station.

Figure 38 illustrates these results for the morning peak (which is generally consistent with the evening results for all stations except Marshall) showing considerable proportions of on-street parking at Lara, North Shore, South Geelong and (for the morning only) Marshall.

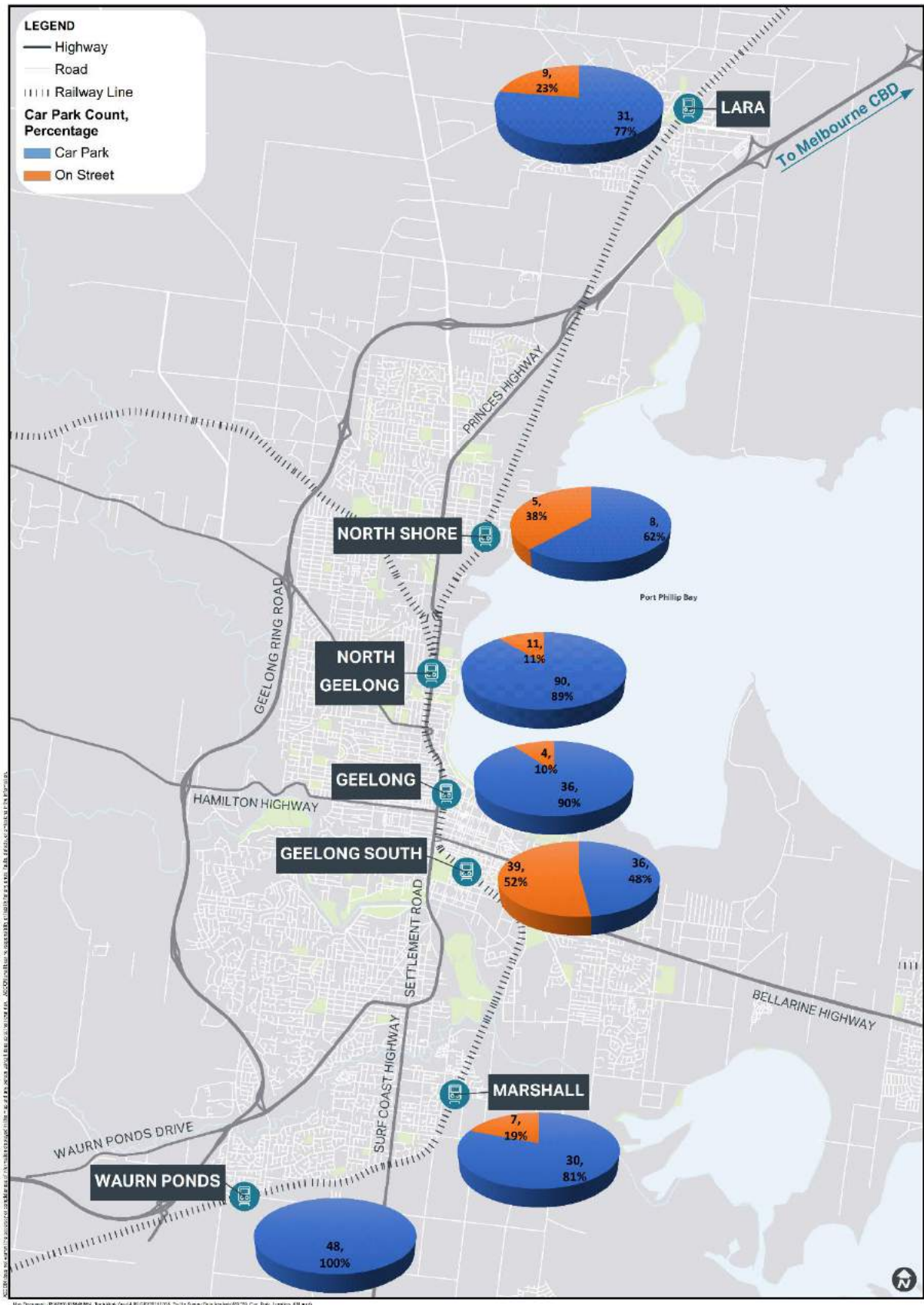
Those parking on-street at North Shore and Marshall were likely doing so for convenience since there was sufficient parking supply off-street (formal or informal) to accommodate them. Those parking on-street near Lara and notably South Geelong stations can be assumed to be reacting to the off-street car park being at capacity from an early hour.

As part of the questionnaire surveys the commuters were asked what suggested improvements they would prioritise for each station or its transport links. Table 28 shows the percentage of the total survey responses for each station that prioritised the need for more parking over other concerns. As shown a total of 854 people were surveyed across all the stations, with 250 (29 percent) indicating a request for more car parking. These requests were most notable at North Geelong (45 percent), South Geelong (43 percent) and Marshall (34 percent).

Table 28 Questionnaire survey - requests for more parking

Station	Total Surveyed	Other Requests	More Parking Requested	
			Total	Percentage
Lara	143	111	32	22%
North Shore	64	62	2	3%
North Geelong	146	80	66	45%
Geelong	157	130	27	17%
South Geelong	185	105	80	43%
Marshall	65	43	22	34%
Waurm Ponds	94	73	21	22%
Total	854	604	250	29%

Figure 38 Car parking location - morning peak time period (6.00-9.30 am)



4.0 Station access opportunities by mode

4.1 Overview of comparative assessment framework

Each of the seven stations in the study area has a distinct character with respect to its design context and access characteristics. To a degree these have been borne out in the survey data presented in the previous sections. This chapter focusses on interpreting the built environment around each of the stations to help explain the survey results, and to help prioritise a program of works for each station that best suits its development surroundings and future access patterns.

To this end an evaluation framework has been developed to assess and compare the constraints and opportunities at each station, including both quantitative and qualitative measures. These measures are based on the Station Access Principles supported by additional measures to evaluate specific access factors relevant to the seven separate station design contexts.

The Station Access Principles include the following main categories. Please see Appendix E for a full description of each.

- Net customer gain
- Multiple mode access
 - Pedestrian access
 - Bicycle access
 - Bus transfers
 - Car access
- Customer information.

This chapter focuses mainly on the assessment of pedestrian and bicycle access at each of the stations, as these are the modes most dependent on the nature of the surrounding environment.

The results of the pedestrian and bicycle access assessments are then combined with conclusions about the nature and expandability of car and bus facilities to produce an overall outlook of the potential for each station to support additional customers.

4.2 Pedestrian conditions evaluation

Pedestrians represent the most flexible and least space intensive of all the potential modes of access to stations. As such they have a very high (nearly unlimited) capacity for growth, given suitable surrounding land use character. For this reason, the maximisation of patronage growth along the corridor would entail prioritisation of pedestrian access at each station that exhibits a context suited to growth in walking activity.

Therefore, in order to begin the comparison of the merits and priorities for each of the seven stations, it is of prime importance to assess the existing nature of the surrounding pedestrian environment to estimate the potential for future growth in pedestrian activity (and pedestrian-based train passengers).

This includes an investigation and evaluation of the following factors:

- **Quality of facilities**
 - Footpath continuity
 - Footpath width
 - Protective buffers (i.e. separation from moving traffic)
 - Safety of traffic crossings
 - Convenience/distribution of traffic crossings

- **Weather/climate protection**
 - Shade (from trees or awnings)
 - Shelter (primarily awnings on continuous building strips)
- **Context**
 - Compatibility of land uses (for pedestrian activity)
 - Building scale (i.e. car or pedestrian-scale building frontages)
 - Contextual gaps in pedestrian environment (vacant lots, blank walls, incompatible uses, surface car parking)
 - Key destinations (offices, apartment buildings, shopping strips, recreational areas).

An estimation of the relative prioritisation of pedestrian activity at stations can be determined by applying a basic scoring system to each of the key qualitative components for each street corridor leading to and from each station. As described in Appendix E, these scores can be grouped into two main sets – ‘quality of facilities’ and ‘context’ – the sums of which can be compared to highlight the strengths and deficiencies of each station area with respect to pedestrian activity.

The average scores for each station (aggregating all the street corridors leading to and from the station entrance) are shown in Table 29. Please see Appendix E for the individual street by street scores for each station.

Table 29 Walking facilities and walking context scores for seven Geelong train stations

	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds
Facilities	5.6	5.2	3.6	6.5	6.6	4.8	8.0
Context	4.8	2.4	6.0	7.2	6.8	5.0	4.0

The results are indicated graphically in Figure 39, grouped into four general scoring categories as shown. The conclusions of this assessment are discussed below.

Figure 39 Comparative analysis of pedestrian conditions

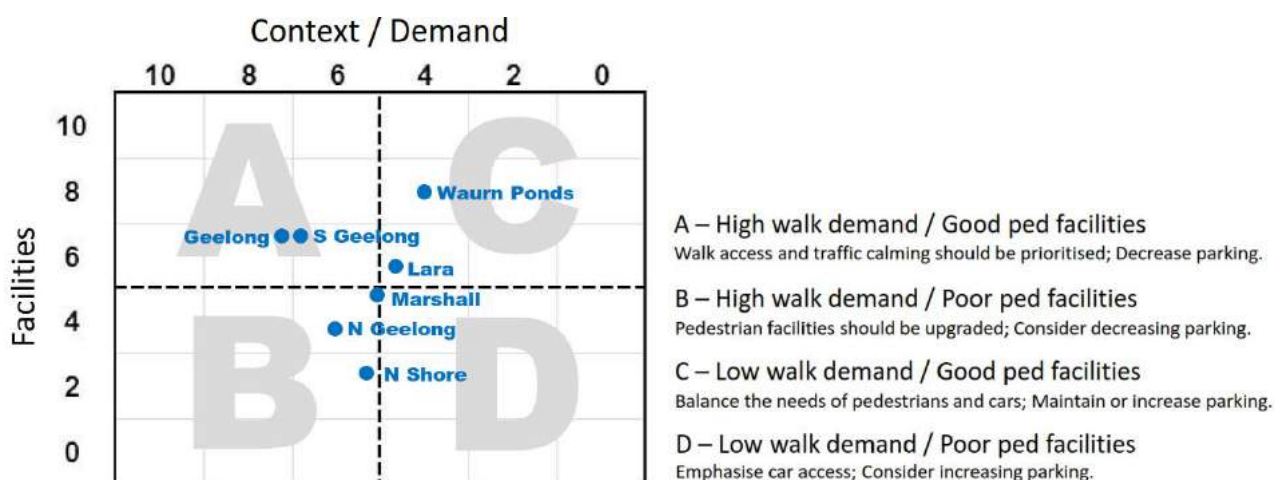


Figure 40 estimates the extent of the walking catchment at each of the seven stations.

Figure 40 Illustrative 1-km walking catchments (10 to 15 minute walk)



As noted in Figure 39, the stations that fall within quadrant A (Geelong and South Geelong) exhibit strong walking contexts (with a diversity of destinations and supportive urban design patterns) and, as such, represent the areas where pedestrian activity can be most relied upon to contribute to station patronage.

Figure 41 Illustrative 1-km walking catchments at Geelong and South Geelong stations (10 to 15 minute walk)



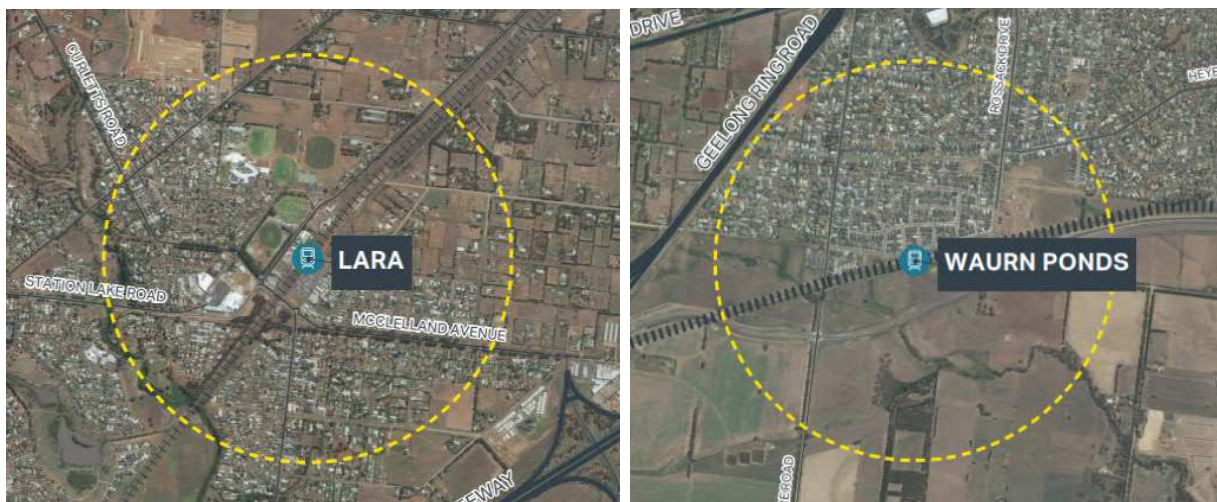
Those falling in quadrant B (North Geelong and North Shore) sit in a context with several potentially strong trip generators but challenging pedestrian circulation conditions, the latter due to a combination of sub-standard walking facilities and considerable traffic barriers. Although some additional pedestrian-focussed trips could potentially be generated through strategic pedestrian access upgrades to contribute to future station patronage, the overarching car-oriented nature of these areas may limit the ultimate results of this approach.

Figure 42 Illustrative 1-km walking catchments at North Shore and North Geelong stations (10 to 15 minute walk)



Lara and Waurn Ponds stations – both falling in quadrant C – exhibit sufficient to very good pedestrian facilities yet exhibit a context that is largely devoid of strong trip generators, with the majority of land within each of these station catchments devoted to lower density residential housing. This suggests a potential strategy of a car parking increase to help serve a wider catchment area, however ensuring that the quality and safety of walking access is not disrupted particularly in the event of future intensified development.

Figure 43 Illustrative 1-km walking catchments at Lara and Waurn Ponds stations (10 to 15 minute walk)



Finally, Marshall station, which sits on the border of all four quadrants in Figure 39, exhibits moderate quality pedestrian facilities in the context of only modest trip generators consisting primarily of low density housing. This leads to the same general conclusion as that for Lara and Waurn Ponds, with the exception that any critical pedestrian access or safety issues be addressed as part of any station upgrade plan. Future land uses at Marshall station should also be considered when designing a program of access enhancements, as a land use scenario supportive of station-side development could significantly enhance the walking context and shift the access priority from cars to pedestrians.

Figure 44 Illustrative 1-km walking catchment at Marshall station (10 to 15 minute walk)



4.3 Cycling conditions evaluation

As with walking, cycling represents a space and infrastructure efficient form of access in comparison with cars, and has the potential for significant growth given supportive local conditions.

As such, the cycling conditions evaluation follows the same general methodology as the pedestrian evaluation but with the focus specifically on cycling, which – in comparison with walking – entails a broader catchment area (particularly notable in the case of destinations and activity generators), with primarily on-road facilities in these areas. Given the latter, the cycling conditions are in general more sensitive to adjacent traffic volumes and speeds than are the separated (i.e. outside the kerbs) walking paths.

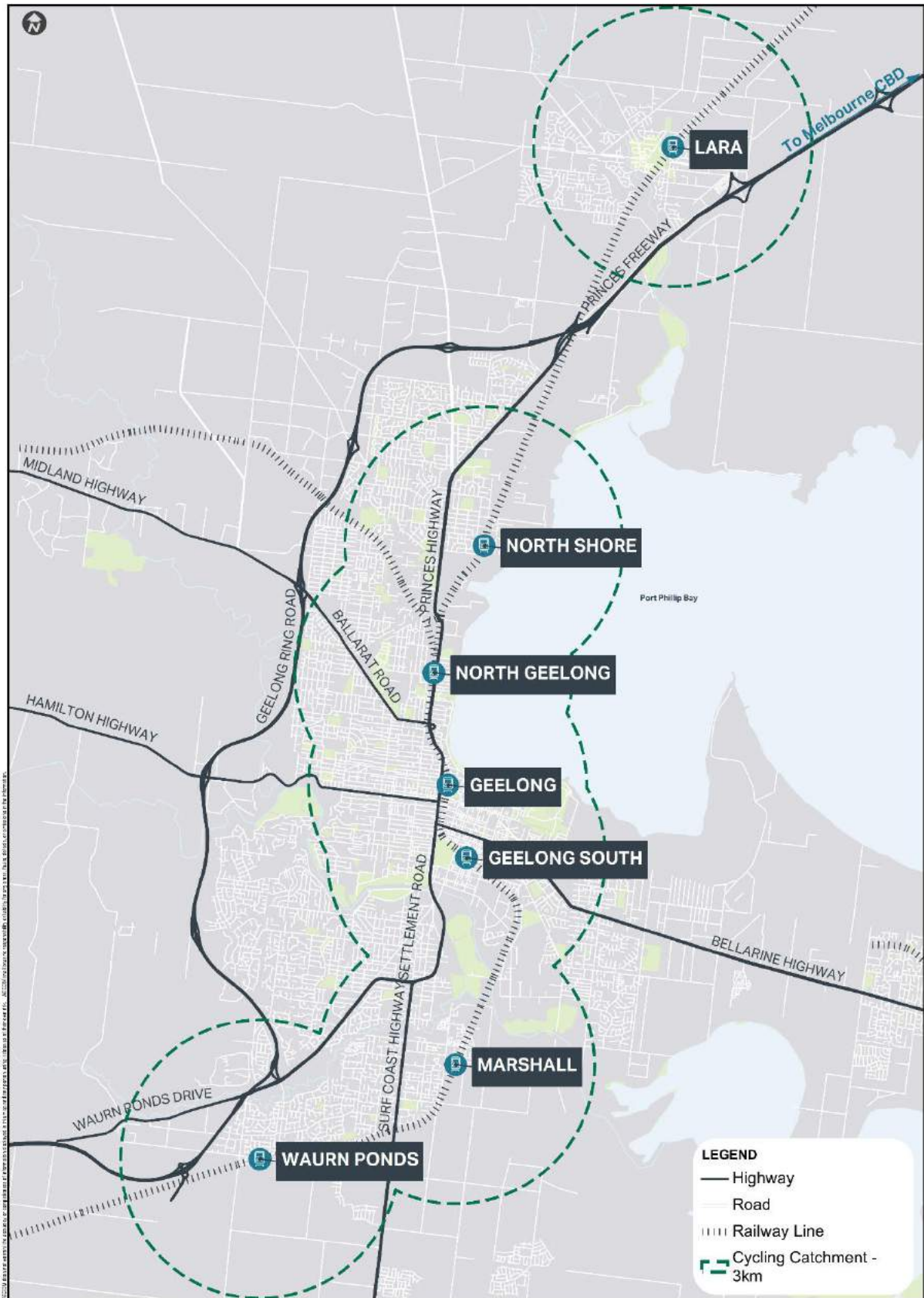
The cycling assessment follows the same basic structure as the pedestrian assessment with the notable additions of traffic speed and turning conflicts, as well as several additional variations pertaining to what constitutes a supportive cycling versus walking context, as follows:

- **Quality of facilities**
 - Continuity of cycle paths/lanes
 - Width of cycle paths/lanes
 - Buffer from traffic
 - Safety of traffic crossings
 - Convenience of traffic crossings
- **Traffic conflicts**
 - Speed of adjacent traffic
 - Frequency of turning conflicts
- **Context**
 - Traffic volumes on corridor
 - Topography
 - Landscape (i.e. presence of natural features conducive to recreational use)
 - Key destinations (offices, apartment buildings, shopping strips, recreational areas)

A number of these factors combine to determine the overall safety of bicycle movements to and from the stations, most notably the continuity and width of cycle lanes, the nature of the buffer from traffic (if any), the safety of traffic crossings, the speed of adjacent traffic, and the frequency of turning conflicts.

Weather is another key contextual consideration that influences the levels of cycling activity, however this factor can be assumed to be consistent across all the stations within the corridor.

Figure 45 Illustrative 3-km cycling catchments



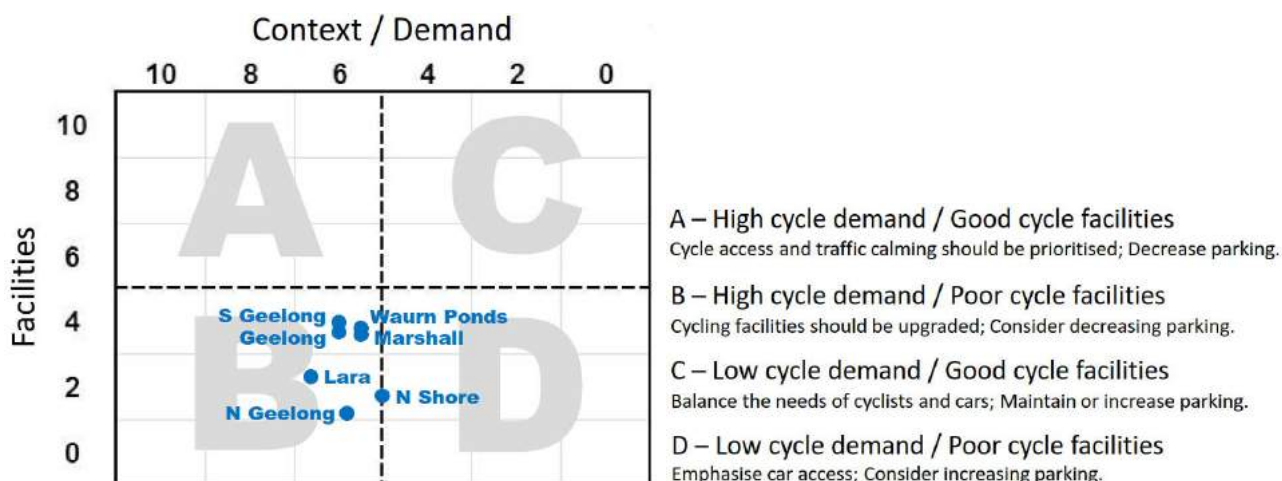
The cycling facilities and context scores are indicated in Table 30. Note that the cycling ‘context’ scores are different than those for walking due to the differing factors that affect cyclists versus pedestrians, as described above. Please see Appendix E for individual scores for each of the key links serving each station.

Table 30 Cycling facilities and cycling context scores for seven Geelong train stations

	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds
Facilities	2.2	1.8	1.2	3.5	3.8	3.5	3.5
Context	6.6	5.0	5.8	6.0	6.0	5.5	5.5

As with the pedestrian assessment, a comparison amongst the main opportunities for each station can be made by plotting the ‘quality of facilities’ scores versus the ‘context’ scores, resulting in the range of outcomes described in Figure 46.

Figure 46 Comparative analysis of cycling conditions



As is evident from Figure 46, each of the stations within the study area falls in or around quadrant B, denoting significant potential cycling demand but largely substandard cycling facilities.

The results and preliminary recommendations of this analysis are subsequently discussed.

Lara and North Geelong each exhibit strong potential cycling attraction but suffer from inadequate or poorly connected cycling facilities, compounded by a high degree of traffic conflicts suggesting uncomfortable levels of mixing between cyclists and cars.

Figure 47 Illustrative 1-km and 3-km cycling catchments at Lara and North Geelong stations



Geelong and South Geelong have strong context scores in combination with moderate facilities scores, underscoring the presence of some level of formalised cycling treatments at and around the stations. However, it should be noted that Geelong station's location near the epicentre of central Geelong leads to a significant degree of traffic conflicts on several of the busy surrounding corridors.

Figure 48 Illustrative 1-km and 3-km cycling catchments at Geelong and South Geelong stations



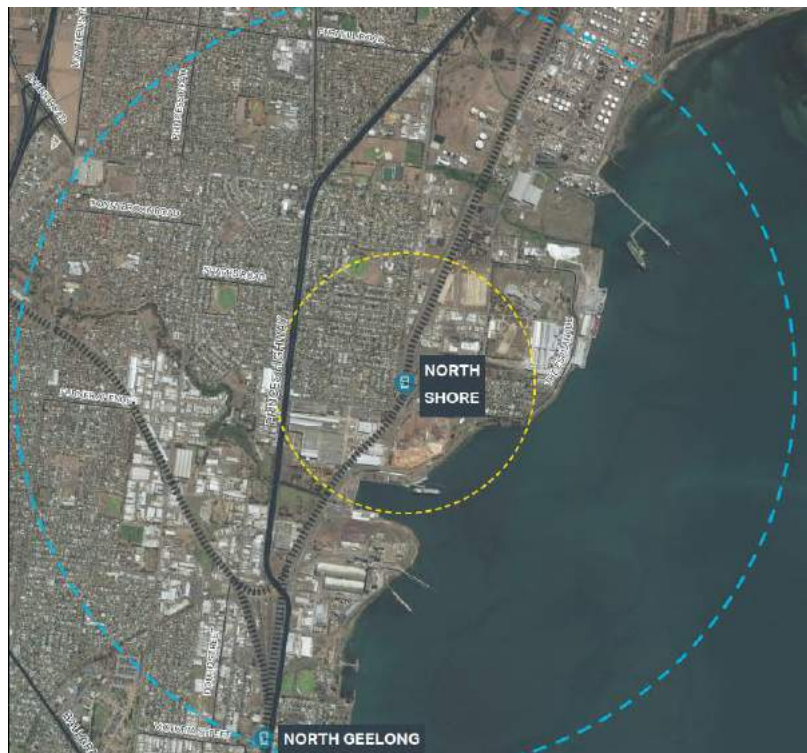
Waurn Ponds and Marshall likewise have moderate quality facilities serving relatively attractive cycling contexts. However, in these cases the context score is influenced more so by the presence of natural surroundings rather than any significant concentration of active cycling destinations, given relatively low density distributions of housing in the immediate station vicinities. Traffic conflicts at these stations are relatively modest given the low-volume residential nature of most of the streets leading to and from the stations.

Figure 49 Illustrative 1-km and 3-km cycling catchments at Marshall and Waurn Ponds stations



Finally, North Shore station has a lower level of potential cycle trip attractors than the other stations, along with a low facilities score and challenging traffic conflicts in the area.

Figure 50 Illustrative 1-km and 3-km catchments at North Shore station



The overall strategy that would emerge from this analysis would include significant cycling facility upgrades at each station, with the greatest potential benefit at Geelong, South Geelong, Lara and North Geelong, each of which is located amongst a diverse range of potential cycling generators.

Traffic conflict management to protect cyclists – including potential road space reallocation and traffic calming – could further contribute to improving the cycling mode share particularly around Geelong, South Geelong, North Geelong and (to a lesser degree due to its less conducive overall context) North Shore stations. However, this would be in context of the strategic cycling corridors as outlined in the Victorian Cycling Strategy.

4.4 Road character assessment

One of the key indicators of the relative priority around each station – and influence on potential upgrade options – is the character of the connecting traffic corridors with respect to volumes, speed, crossing locations and orientation, and parking (on and off-street). A mismatch between the road character and surrounding land use/urban design context could limit the level of walking and cycling mode share that can be achieved.

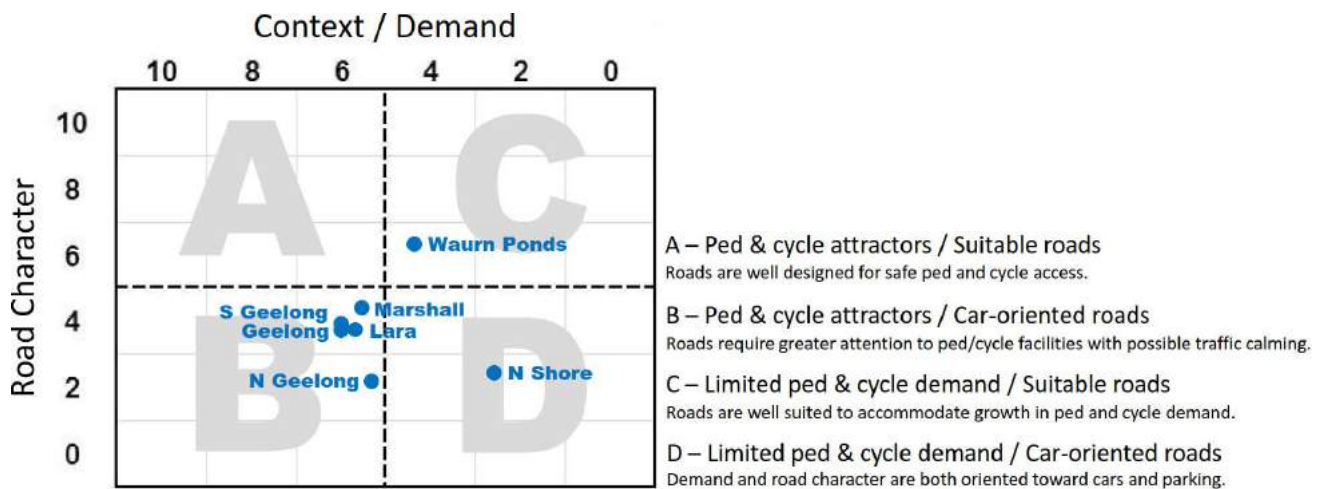
This exercise is intended to inform whether road space reallocation, traffic calming, or other road management measures may be needed to optimise the mode shares of each station area by ensuring their connecting road corridors are suited to their overall combined purpose. The results of this analysis have been used to inform the level of compatibility with the Station Access Principles, as discussed in Section 4.5.

For this assessment a road character score for each connecting corridor can be compared with its context score – drawing from elements of both the pedestrian and cycling assessments -- to determine whether the corridor is well suited to its potential active transport usage. Please see Appendix E for a full listing of the key variables for this analysis, as well the street-by-street qualitative scores.

As with the pedestrian and cycling assessments, the ‘road character’ and ‘land use/design context’ scores can be plotted against each other to provide an indication of whether the facilities match the diversity of demand. In the case of road character, the difference between these scoring components can also indicate the magnitude of any mismatch.

Figure 51 shows the summarised results of this evaluation. Please see Appendix E for the detailed street-by-street qualitative scores applied to each of the specific evaluation factors.

Figure 51 Comparative analysis of station-area road character



As can be seen from Figure 51, the majority of the seven stations – Geelong, South Geelong, Lara, North Geelong and Marshall – fall into quadrant B, with a significant level of combined pedestrian and cycling attractors but roads that can be mainly described as car-oriented. This would suggest that some traffic calming or traffic management measures are likely to be necessary for each of these stations in order to achieve their full potential with respect to mode shares for walking and cycling.

The roads surrounding North Shore Station likewise exhibit a predominantly car-oriented character, but the lower concentration of potential walking and cycling attractors in this area means that the high traffic volumes and speeds are less of a hindrance to active transport growth as they are at the other stations.

In comparison with the other six stations, the area surrounding Waurn Ponds station is characterised by roads that are generally well suited to active transport, notwithstanding a lack of formalised cycle paths or road markings. This is due largely to their narrow sections and modest traffic volumes.

Table 31 shows the differences between the road character and context scores for each station to illustrate the magnitude of any deficiencies in the suitability of streets for all their varied users. Large negative values (-2 to -3) indicate highly car-oriented streets despite development contexts that are otherwise well suited to walking and cycling activity.

Table 31 Summary of road character analysis results by station

Station	Road character score	Context score	Difference
Lara	3.6	5.6	-2.0
North Shore	2.4	2.6	-0.2
North Geelong	2.2	5.2	-3.0
Geelong	3.5	6.0	-2.5
South Geelong	3.6	6.0	-2.4
Marshall	4.3	5.5	-1.2
Waurin Ponds	6.3	4.3	2.0

4.5 Strategic comparison of stations

The results from the walking, cycling and road character assessments can be consolidated – along with consideration of bus service patterns, parking data and physical constraints – into an overall comparison framework highlighting the opportunities for patronage growth by mode at each station. This framework is based on the Station Access Principles established to help optimise station arrival patterns to make best use of each connecting mode option, given the context of each station. When viewed systematically, this can help inform the determination of which stations are best positioned to absorb future parking increases, and which would be better served by optimising access by pedestrians, cyclists and buses.

The components of this overview analysis – consistent with the Station Access Principles – are as follows:

Net customer gain: These are the primary numerical scores describing the potential for each station to attract future riders from a variety of modes of access, drawing from the more fine-grained data calculated under 'multiple mode access' as described in the next sub-heading.

- Gain or loss of passengers
- Increased bus services
- Increased pedestrian activity
- Improved cycling access.

Multiple mode access: These scores draw from the conclusions of the walking, cycling and road character assessments, or from additional analyses as noted below. Please see Appendix E for full details on how these scores have been calculated.

- Pedestrian
 - Activity
 - Connectivity
 - Accessibility
- Bicycle
 - Ability to accommodate cycle parking
 - Location of and access to cycle parking
 - Directness of connections
 - Quality of connections
 - Conflict management

- Bus
 - Location of interchange
 - Size/expandability of interchange
 - Connection between buses and rail platforms
 - Strategic network integration
- Car
 - Parking space efficiency: Adaptability of parking layout
 - Parking space efficiency: Strategic corridor positioning
 - Parking space priority: Roadway access
 - Parking space priority: Compatibility with land uses

Each of these factors are used to calculate a total score for each station for each mode of access, based on a set of weightings that calibrate each modal score to a 0 to 10 scale. The result is a snapshot of how well placed each station is to accommodate patronage growth for each mode of access.

The figures extracted from the detailed mode by mode analysis are subsequently compared and standardised into a simplified scale to inform the potential level of net customer gain relating to each of the evaluated modes of access. These results are presented in Table 32, with the deepest green colours representing the strongest opportunities for future customer gain based on both station and contextual conditions, and the red cells indicating a potential loss of customers for a specific mode of access.

Table 32 Results of the strategic comparison of stations

Station Enhancement Potential	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds
Net customer gain							
Gain or loss of parking	0	1	2	-2	0	0	0
Increased bus services	2	1	0	2	2	2	1
Increased pedestrian activity	1	1	1	2	2	1	1
Improved cycling access	2	1	1	1	2	1	2

Key:

-2	0	1	2
Customer Loss		Customer gain	

The single red cell in Table 32 – alluding to car parking for Geelong station – indicates a potential longer-term loss of surface area devoted to parking due to future redevelopment projects that may build upon its positioning within the commercial pedestrian-scale centre of Geelong. In this case there would be an opportunity to compensate for loss of car access with strong potential patronage gains through increased bus services, pedestrian activity and/or cycling growth.

These results have been drawn from the scores for each station against each of the individual Station Access Principles shown in Table 33, as informed by the walking, cycling and road character assessments. Please note that these scores are derived from – but not the same as – the ‘facilities’ and ‘context’ scores from the earlier analyses. Appendix E provides an expanded version of this table and further information as to how these scores have been calculated.

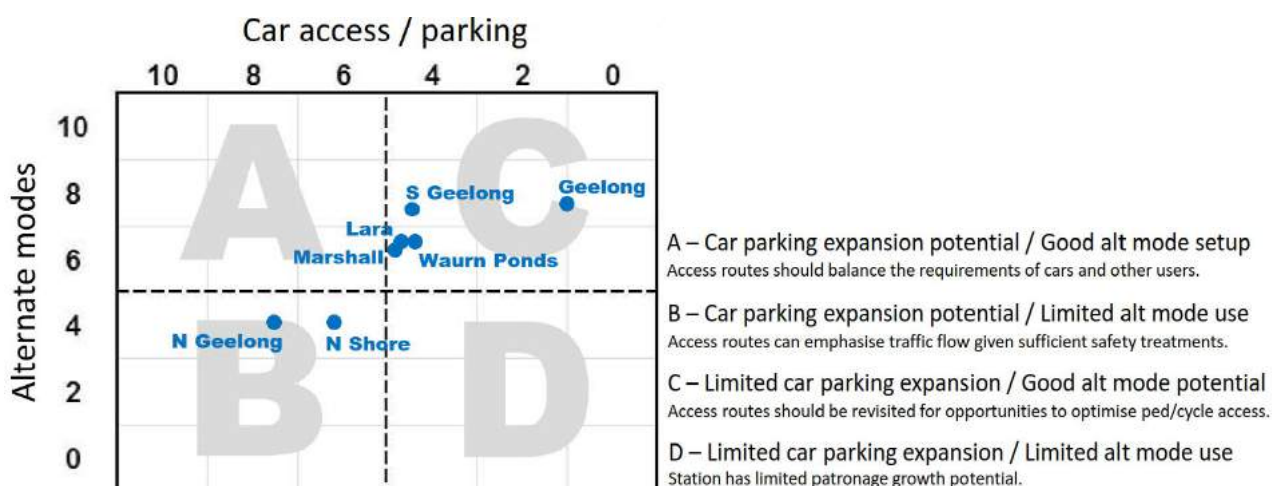
Table 33 Scores for each station for Station Access Principles by mode

Station Enhancement Potential	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds
Multiple mode access							
Pedestrian	5.3	4.3	4.5	7.2	6.8	4.8	6.4
Bicycle	6.3	4.0	5.9	5.3	6.4	5.8	7.1
Bus	8	4	2	10	9	8	6
Car	4.7	6.2	7.4	1	4.5	4.75	4.375
Car (adjusted)	1.9	4.9	4.8	-2.0	1.5	2.0	2.3
Average of alternative modes	6.5	4.1	4.1	7.5	7.4	6.2	6.5

All in all, the station with the most likely gain from increased car parking would be North Geelong, which has both a station footprint and road access orientation suited to arrivals by car. North Shore may also be a candidate for further parking notwithstanding the narrow footprint of its present car park, while strategic car parking expansion opportunities also exist at Marshall and Waurm Ponds to accommodate growth in these areas. As indicated in Table 32 these two outlying stations are also well suited to growth through other forms of station access.

It is also useful to plot the car access scores versus the average of those for the ‘alternative’ modes to provide an indication of the priorities for each station, i.e. car access improvements or walking/cycling enhancements, as shown in Figure 52.

Figure 52 Comparison of access priorities by station



As can be seen in Figure 52, each of the seven Greater Geelong railway stations falls within either quadrant B or quadrant C.

For those that fall into the former – North Geelong and North Shore stations – the maximisation of future patronage growth would most likely rely on car parking expansion and upgrades to car access routes, given limited potential with respect to alternative modes in these locations.

Each of the other stations sits within a multifunctional context more conducive to the use of alternate modes, and exhibit bus facilities and pathway networks that are sufficient (or upgradeable) to absorb increases in public and active transport access. This balance is most shifted toward alternate modes in the case of Geelong station, which has no car parking expansion potential and is better suited to the conversion of existing parking to other modes and land uses, given its city centre context.

4.6 Recommendations based on background context analyses

Taken together, the pedestrian, cycling, road character, and patronage growth assessments can inform the direction for improvements to each station area, to most efficiently cater to patronage demand along the full corridor. These recommendations are summarised in Table 34.

Table 34 Constraints, opportunities and recommendations

	Constraints	Opportunities	Recommendations
Lara	Car park is constrained with just marginal space for growth without decking.	Context is well suited to use of alternate modes given supportive infill development near the station.	Emphasis should be on accommodating increased bus services and improving cycle connections.
North Shore	Car park is narrow and constrained with some possibility of linear expansion or decking.	Good road access could offer efficient delivery of cars to the site from the arterial road network.	Opportunities for car park expansion should be investigated.
North Geelong	Proximity to Princes Highway impedes walking and cycling activity to the east.	Good road access and a large car park footprint could be well suited to parking expansion.	Opportunities for car park expansion should be investigated.
Geelong	Car park is irregularly shaped and constrained by development on all sides.	Context is conducive to significant walking and cycling activity assuming sufficient path upgrades. Bus transport usage increases.	Traffic calming and road space reallocation should be investigated to improve walking/cycling comfort.
South Geelong	Road access is sub-optimal necessitating the use of residential streets to access the station.	Context is well suited to walking and cycling access.	Traffic calming and expansion of cycle parking could contribute to further alternate mode access.
Marshall	There is a lack of direct connectivity with surrounding development.	The location and orientation of this station suggest a balanced approach toward accommodating all modes.	Improved walk/cycle access and expansion of car parking should both be investigated.
Waurn Ponds	Car park and connectivity is confined to just the northern side of the station.	The location and orientation of this station suggest a balanced approach toward accommodating all modes.	Cross-railway connectivity is being provided under the Government Commitment to the South Geelong to Waurn Ponds rail upgrade, and should be integrated with the active transport links provided within the Armstrong Creek Urban Growth Area, including connections into the shared path that was built on the North Side of Baanip Blvd. These connections would enable efficient movement among the communities of Waurn Ponds, Grovedale and the Armstrong Creek Urban Growth Area.

While there may be some variation in approach as the design constraints and opportunities at each station are examined in further detail, this analysis has provided a framework for prioritising certain aspects of access at each station.

As a result, the opportunities presented here have been carried forward to the options analysis for the purposes of maximising the return on future station upgrades and associated access improvements.

Options developed on the basis of these observations also recognise that the long term goal for Geelong Station – as determined through prior and concurrent studies – is “*to develop a commuter parking strategy for train stations within Geelong to reduce all day commuter parking in central Geelong over time*”, as expressed in the Revitalising Central Geelong Action Plan. The displaced parking demand for Geelong Station is discussed in the summary of modelling scenarios (Chapter 5.0) and reflected in the station development options presented in Chapter 6.0.

5.0 Patronage forecasting

AECOM have undertaken strategic modelling to estimate the future patronage demands by access mode to each of the study railway stations, which is a key objective to inform the Geelong Commuter Car Parking Strategy.

This chapter outlines an overview of the modelling process and the subsequent findings. A more detailed summary of this exercise is included in Appendix F, while the full technical demand forecasting report can be found in Appendix G..

The modelling undertaken for the project has been reviewed by the Transport for Victoria (Melbourne) modelling team and certified 'fit-for-purpose' to inform this commuter car parking strategy.

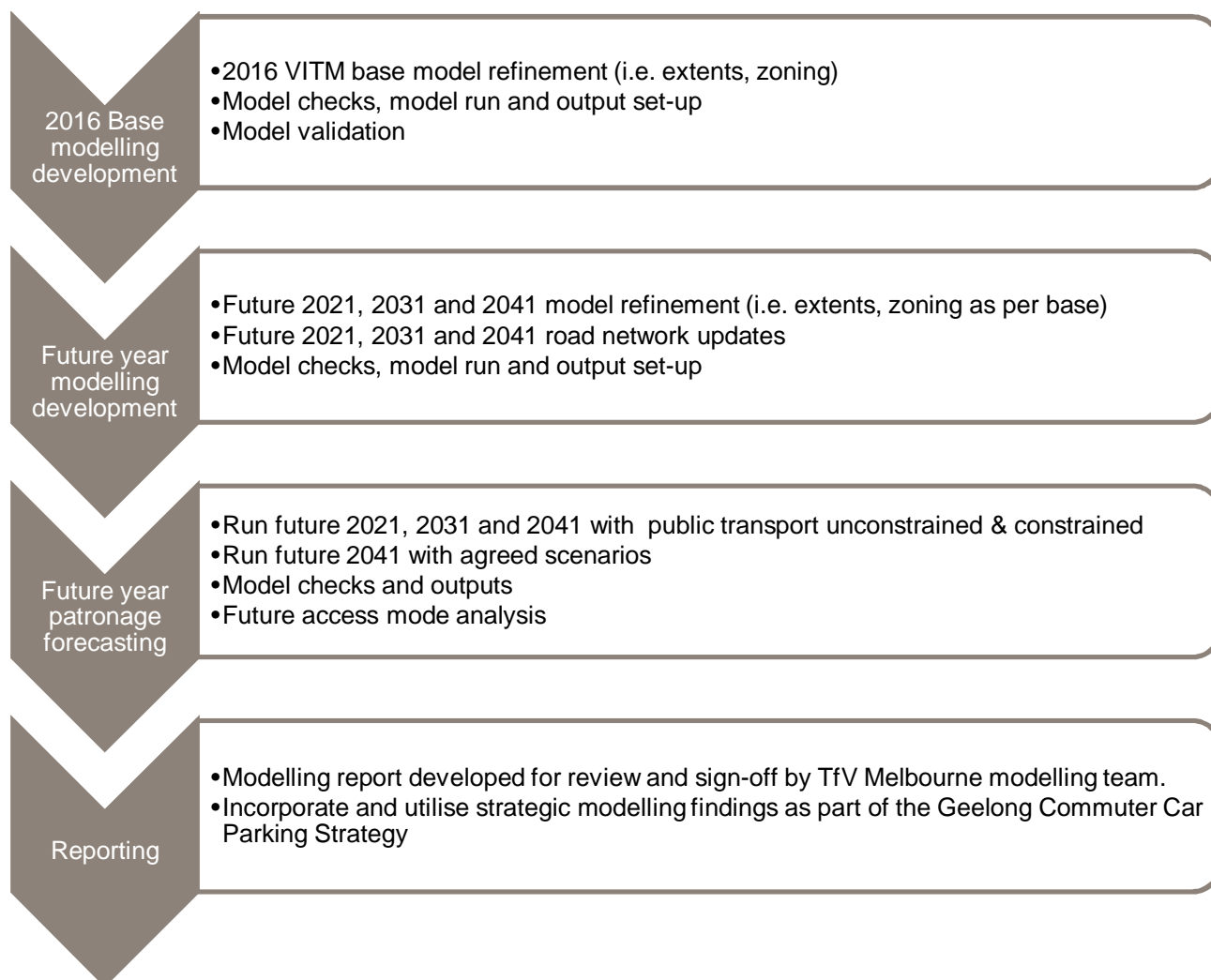
5.1 Modelling overview

The patronage forecasting for the project was undertaken using the statewide version of the Victorian Integrated Transport Model (VITM), a tool developed and maintained by TfV to assist in the planning of road and public transport infrastructure in Victoria.

The VITM is a four-step strategic traffic model which encompasses population, employment and land use projections to forecast future travel behaviours and the potential impacts to the road network.

An overview of the modelling methodology for this project is shown in Figure 53.

Figure 53 Modelling methodology overview



5.2 Modelling scenarios

The main purpose of the strategic modelling exercise is to determine travel demand by access mode (including parking demand) at railway stations within the study area.

To estimate the base growth factors, the model runs for the 2016 base year and future years were set with unconstrained public transport capacity and park and ride capacity so that they can forecast public transport demand and growth without constraint.

The VITM was also run with “double constraints” for all modelling years to provide a more realistic set of growth factors, consisting of the following:

- Public transport vehicle capacity constraints
- Park and ride constraints at stations.

Variations for future year 2041 included scenarios of high population growth provided by City of Greater Geelong Council and scenarios with reduced parking capacity at Geelong station.

The modelling scenarios are shown in Table 35.

Table 35 Modelling scenarios

Scenario No.	Year	Public Transport Unconstrained/Constrained	Land Use	Road Network	Public Transport Services
1	2016	Unconstrained	TFV	2016 Reference	2016 Reference
2	2016	Constrained	TFV	2016 Reference	2016 Reference
3	2021	Unconstrained	TFV	2021 Reference	2021 Reference
4	2021	Constrained	TFV	2021 Reference	2021 Reference
5	2031	Unconstrained	TFV	2031 Reference	2031 Reference
6	2031	Constrained	TFV	2031 Reference	2031 Reference
7	2041	Unconstrained	TFV	2041 Reference	2041 Reference
8	2041	Constrained	TFV	2041 Reference	2041 Reference
9	2041	Constrained	Council	2041 Reference	2041 Reference
10	2041	Constrained	Council	2041 Reference	2041 Reference; Zero parking spaces at Geelong Station
11	2041	Constrained	TFV	2041 Reference	2041 Reference; Zero parking spaces at Geelong Station
12	2031	Constrained	TFV	2031 Reference	2031 Reference; Zero parking spaces at Geelong Station

The scenarios are further described below:

- The unconstrained public transport scenario represents a situation in which the capacity of train services and number of parking spaces at the stations have no impact on the estimation of public transport travel demand.

- The constrained public transport scenario represents a situation where, if the train capacities or number of parking spaces at the stations are exceeded, passengers would face a penalty in terms of delay and be encouraged to switch to other transport modes or other stations.
- The reference road network would include the road network upgrades as per the 2012 GGATM model, provided by TfV.
- Scenarios 1, 3, 5 and 7 are referred to as the “base” runs, and were used to calculate unconstrained growth of patronage at the railway stations within the study area for 2016, 2021, 2031 and 2041, respectively.
- Scenarios 2, 4, 6 and 8 were used to calculate constrained growth of patronage at the stations for the same years.
- Scenario 9 used the land use data provided by Greater Geelong Council. It was compared against Scenario 8 to indicate the impact of high population growth on the station patronage.
- Scenario 10 assumed that the off-street parking capacity at Geelong station was reduced to near zero, while the parking capacity at other stations (such as Lara, North Geelong, and Marshall) would remain unchanged. Like scenario 9, scenario 10 used the Council land use data.
- Scenario 11 is similar to Scenario 10 except that the TfV land use data was used.
- Scenario 12 is similar to Scenario 11 but run for year 2031 to estimate the impact of Geelong station parking removal for an intermediate year.

5.2.1 Modelling summary results

Figure 54 provides an overview of the modelling results for the park and ride demand for the considered model scenarios, highlighting a general growth trend for Lara, North Geelong, Marshall and Waurn Ponds stations.

The primary difference between the constrained and unconstrained models is the manner in which they address park and ride loading. The unconstrained model uses a default park and ride delay of 5 to 10 minutes at all stations irrespective of the station capacity. In other words, the time it would take each passenger arriving by car to enter the car park, locate an available parking space, and walk to the platform would be consistent for all passengers at all stations.

In contrast, the constrained model uses park and ride delay starting from 3 minutes for under capacity stations (such as North Shore) and increasing quickly to 15 to 60 minutes for over capacity stations. The model subsequently shifts park and ride demand from over capacity stations to the others in response to high levels of park and ride delay. Overall, the constrained model is considered as more realistic than the unconstrained model, and its results should be used in subsequent stages of station planning.

Please see Appendix F for discussions of kiss and ride, cycling, walking and public transport growth for each of the evaluated scenarios.

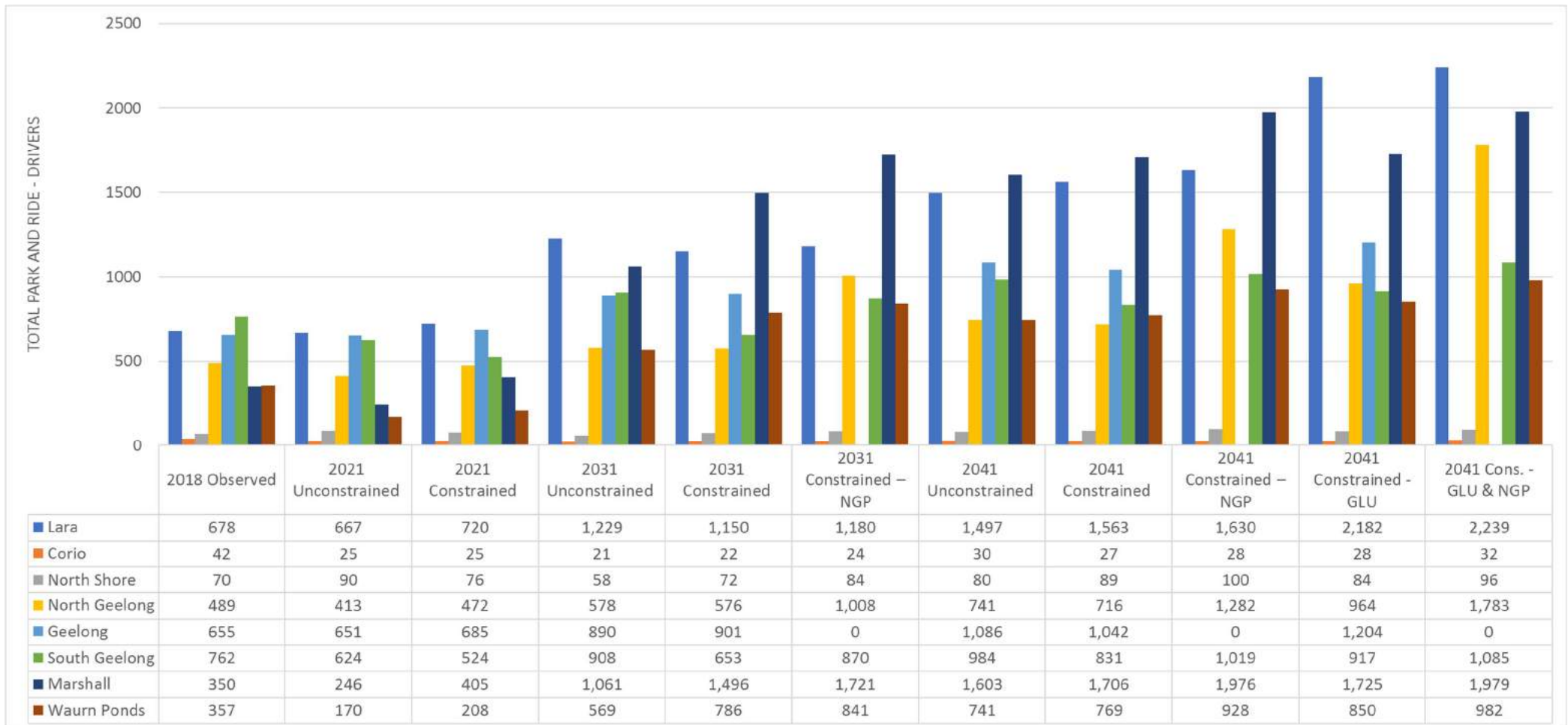
5.2.2 Other modelling dependencies

It should be noted that the Geelong Growth Area Transport Infrastructure Strategy (as part of the VPA Streamlining for Growth initiative) was commissioned after the Geelong Commuter Car parking study, however population growth has been considered through the additional scenarios based on Geelong Council's small area projections.

Furthermore, the Torquay Transit Corridor (TTC) study was also commissioned after the Geelong Commuter Car parking study. Future consideration of the TTC study could lead to further refinement of the options that are recommended for Waurn Ponds and Marshall stations. This study supports a coordinated approach to integrate key transport projects including the planned Torquay Transit Corridor.

Corio station was modelled in this study however options development and costings were not undertaken for Corio station, due to the reasons outlined previously in section 1.5 of this report.

Figure 54 Summary of station daily entries by park and ride (driver only) under all scenarios



Key: GLU – Geelong Land Use NGP – No Geelong Parking

5.2.3 Summary of key findings from modelling summary results

5.2.3.1 Overview of unconstrained model scenario

With no constraints on demand, the model forecast indicates that the total daily passenger entries to all study stations would increase from 8,700 in 2018 to 9,700 in 2021 to 16,000 in 2031 and 20,100 in 2041 (growth of 2.4% p/a) based on the TfV land use scenario, or 21,400 (growth of 2.5% p/a) based on the Council land use scenario. SGS economics assessment for council predicts growth at 2.7% p/a for the same period.

The parking demand is forecast to grow from 2,500 cars in 2018 to 5,800 cars (TfV land use) or 6,800 cars (Council land use) in 2041.

5.2.3.2 Overview of constrained model scenarios

Given capacity constraints, the total passenger demand is predicted to grow to 9,700 entries in 2021 to 19,000 in 2041, approximately 5 percent less than the unconstrained predictions. Overall the station entries represent a growth of 3.4 percent per annum between 2021 and 2041.

Similarly, the parking demand is predicted to grow to 2,700 cars in 2021 to 5,800 cars in 2041.

When comparing the Council land use scenario against the TfV land use scenario for 2041, the total entries at the stations would be 12 percent higher for the former, while the parking demand would be 16 percent higher. This result owes to the higher development intensities of the Council scenario.

At the station level, Council land use would result in an increase of entries at Lara, North Geelong and Geelong stations by 25 percent, 22 percent and 14 percent, respectively. (Please note that these results do not include the removal of parking at Geelong station – see section 5.2.3.3.) Similar growth patterns can be seen in the predicted parking demands which would increase at the same stations by 34 percent, 25 percent and 25 percent respectively. This pattern would be due to the distribution of the additional population at the growth areas near the stations.

5.2.3.3 Removal of parking at Geelong station

When the parking at Geelong station is removed, the passenger demand by park and ride would be reduced by 100 percent, however the other access modes to the station such as kiss and ride, cycle, public transport and walking are predicted to increase by 24 percent, 60 percent, 33 percent and 24 percent, respectively. These projections are consistent with City of Greater Geelong's Clever and Creative Future strategy, which sets a target that 50 percent of access to Central Geelong will be via sustainable modes of transport.

Overall the passenger entries to Geelong station would decrease slightly by 3 percent.

In this scenario it is predicted that the park and ride demand at the adjacent stations of North Geelong and South Geelong would increase by 85 percent and 18 percent, respectively. Similarly, the park and ride demand at further away stations like Corio, North Shore, Marshall and Waurn Ponds would increase by 14 to 16 percent, while at the farthest (Lara) it would increase by 3 percent.

5.2.3.4 Predicted future parking requirements – all scenarios

The following tables provide the predicted future commuter car parking requirements from the undertaken modelling:

- Table 36 outlines the projected parking demands and consequent parking shortfalls at Lara, Corio, North and North Geelong stations under all the model scenarios.
- Table 37 outlines the projected parking demands and consequent parking shortfalls at Geelong, South Geelong, Marshall and Waurn Ponds stations under all the model scenarios.
- Table 38 outlines the predicted study corridor parking requirements and shortfalls across all the model scenarios.

Table 36 Summary of station car parking demand under all scenarios – Lara, Corio, North Shore and North Geelong stations

Station	Lara		Corio		North Shore		North Geelong	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2021								
Constrained	606	33	20	61	67	-2	458	96
2031								
Constrained	967	-328	18	63	61	4	574	-20
Constrained - NGP	993	-354	19	62	71	-6	853	-299
2041								
Constrained	1,313	-674	21	60	74	-9	714	-160
Constrained - NGP	1,370	-731	22	59	83	-18	1,087	-533
Constrained - GLU	1,800	-1,161	20	61	74	-9	940	-386
Cons.- GLU & NGP	1,848	-1,209	23	58	83	-18	1,459	-905

Key: GLU – Geelong Land Use NGP – No Geelong Parking

Table 37 Summary of station car parking demand under all scenarios – Geelong, South Geelong, Marshall and Waurin Ponds stations

Station	Geelong		South Geelong		Marshall		Waurin Ponds	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2021								
Constrained	527	-63	518	35	309	138	188	185
2031								
Constrained	680	-216	653	-100	1,169	-722	700	-327
Constrained - NGP	-	-	771	-218	1,326	-879	734	-361
2041								
Constrained	777	-313	831	-278	1,343	-896	682	-309
Constrained - NGP	-	-	895	-342	1,538	-1,091	814	-441
Constrained - GLU	902	-438	917	-364	1,349	-902	758	-385
Cons.- GLU & NGP	-	-	963	-410	1,539	-1,092	853	-480

Key: GLU – Geelong Land Use NGP – No Geelong Parking

Table 38 Total study area car parking provisions

Scenario	Predicated parking requirements	Total shortfall in commuter car parking
2018 surveyed parking supply	3,176	-
2018 surveyed parking demand	2,934	242
2031 constrained model	4,822	- 1,646
2031 constrained model - NGP	4,767	-1,591
2041 Constrained	5,755	-2,579
2041 Constrained - NGP	5,809	-2,633
2041 Constrained - GLU	6,760	-3,584
2041 Constrained - GLU & NGP	6,768	-3,592

Key: GLU – Geelong Land Use NGP – No Geelong Parking

6.0 Options development

This chapter of the Geelong Commuter Car Parking Strategy outlines at a high level the options for strategic and station level development to inform the next steps and recommendations for consideration by Department of Transport and its stakeholders.

Although the strategic modelling predicts the potential required parking provisions for each of the respective stations along the study corridor, catering to these parking projections in the current format (i.e. general use parking free of charge for all users) will lead to higher traffic levels and may contradict various recent Geelong policy documents which have a clear preference for reduced private car travel and greater use of sustainable transport.

As the growth areas of Geelong are not ideally placed to take advantage of active transport links given their distance from the existing railway stations, increased use of feeder bus routes may be key in driving a change in how commuters would typically access the stations. Consequently, this strategy requires a balanced approach that caters to some level of growth in park-and-ride commuting while helping to transition travel behaviour in the longer term to be more consistent with sustainable access and additional local objectives (such as the Marshall Precinct Structure Plan).

With the above in mind this chapter outlines the following:

- Section 6.1: Strategic level options and considerations to improve accessibility by all modes of transport
- Section 6.2: Potential short, medium and long term improvement options for the stations.

6.1 Strategic level options development and considerations

6.1.1 Commuter parking charges

The basis of a free parking policy for commuters is meant to result in people driving to the station and catching the train to their destination, therefore reducing the need for people to drive directly to their destination. However, the provision of free parking can also undermine local sustainability objectives by encouraging many people who live within sustainable travel mode catchments to drive to the stations rather than walking, cycling or using the bus.

There are many precedents of charging for commuter parking to encourage the use of sustainable transport and/or to control the relative levels of parking demand amongst the stations along a corridor. There are also precedents for applying variable parking charges to different carpark locations at the same station to help spread the concentration of access and egress or to help reduce vehicle circulation in the most centralised parking areas.

The fees collected could be used to either maintain existing infrastructure or provide more parking infrastructure. Parking fees could also be used to improve the sustainable transport links to and from the relative station within the first/last 800 metres, potentially including:

- Wayfinding / signed walking routes
- Bike hire schemes
- Car share schemes
- Community bus service
- Bus stop enhancements
- Cycle path improvements.

Next steps: Undertake a policy review for the implementation of future commuter paid parking, with the premise that this will attempt to encourage locally resident commuters to utilise sustainable modes of transport (walk, cycle or bus) rather than private car.

This would entail the following sub-tasks:

- Literature review of station car parking schemes in other cities
- Demand elasticity analysis of potential parking charges along the Geelong corridor. Demand elasticity is a measure of the responsiveness of parking demand to changes in price. A study of demand elasticity would help to determine the optimum pricing point for each station, i.e. that which would enable effective management of parking throughout the corridor without deterring overall train patronage.

6.1.2 Public transport frequencies and connectivity

One of the key requests from commuters that most frequently recurred in the questionnaire surveys was improvement to the frequency and connectivity of public transport, in the form of:

- greater total number of peak and daily trains (i.e. to reduce overcrowding of services)
- higher frequency of both trains and buses
- better timing between buses and trains.

Few of the buses that feed into the Geelong railway corridor could be considered as ‘turn up and go’ services, meaning that use of the bus must be carefully planned and that any missed connections could result in a wait of 20 to 40 minutes for some routes.

Bus connectivity within high growth areas should be addressed at the early stages of planning to support and encourage the use of feeder bus services to the stations, as a lack of quality services at the outset may make it more difficult to encourage sustainable travel patterns in the future. In addition, rail service increases at North Shore station has the potential to accommodate a larger portion of park and ride commuters in the future.

Next steps: In consultation with key stakeholders, investigate the potential for improvements to public transport frequencies and connectivity. This should include evaluation of potential upgrades to service frequencies on existing routes as well as introduction of new services, particularly to serve emerging growth areas to the north, west and south of the railway corridor.

6.1.3 Accommodation of emerging rideshare technologies

The trend towards Autonomous Vehicles (AVs) and electric vehicles (EVs) has been a focus in research and development in recent years, and as the prospect draws closer of AVs and EVs becoming mainstream it is more widely accepted that they have the potential to significantly alter day-to-day travel behaviour.

However there remains a great deal of uncertainty over how AVs and EVs can be successfully integrated with the existing ground transport system, representing significant challenges for the planning, engineering and design of station facilities.

6.1.3.1 Electric vehicles

Should the vehicles of the future continue to run on conventional petrol/diesel – or cleaner versions thereof – no significant changes to refuelling infrastructure are anticipated. In contrast, if electric vehicles become widespread, significant changes to the form and location of refuelling infrastructure will need to occur, which would have implications for parking facility design particularly with respect to the need for electrical recharging stations.

The level of uptake of shared services will also affect demands on recharging infrastructure, and by implication the design standards for parking facilities, if there is a concurrent shift to electric vehicles for these services as is generally expected. For instance, if most vehicles within the mobility system continue to be privately owned (including AVs) the need for widely distributed refuelling stations would be greater than if the majority of vehicles on the network were operated as part of a shared on-demand fleet. This would have direct implications on the proportion of station carparks that would need to be dedicated to electric vehicles.

6.1.3.2 Autonomous vehicles

In the next few years, cities may experience the initial stages of fully autonomous vehicle use. While full deployment of this technology is still expected to be decades away, in the shorter term there may be a transition period with autonomous and conventional vehicles each accounting for significant portions of overall road travel demand. These different stages of uptake would have different infrastructure requirements with respect to the design of carparks. There are also many uncertainties into how the future will unfold in terms of whether most AVs will be privately owned or form part of a shared on-demand fleet.

The uptake of AVs is expected to result in a relatively moderate decrease in the overall level of commuter car access demand at stations, though a shift from individual carparks to kiss-and-ride or dedicated AV pickup/drop-off areas will occur. Some parking demand may also be reassigned from parking at stations to more remote stabling facilities where AVs can be staged prior to the peak periods to await call-up to pick up locations, similar to the manner in which taxis currently operate at Melbourne Airport.

The decrease in off-street commuter parking demand expected to occur as a result of increasing AV uptake means that much of the parking infrastructure currently being planned (including as part of this study) will need to be designed and built in a manner that is resilient and adaptable to changing longer-term conditions.

An example of potential changes to parking policy to support adaptability of parking facilities is currently under consideration by Melbourne City Council. This change would require structured above-ground parking to incorporate minimum 3.5 metre floor-to-floor heights, flat floorplates or stacker systems appropriate for future retrofit to alternate uses, as stipulated in the Central Melbourne Design Guide, City of Melbourne (June 2018). Structural, mechanical, electrical, plumbing, geotechnical, and fire resistance considerations are all required in the planning of new parking structures.

Automation of light vehicle passenger transport will create a range of opportunities to increase the efficiency of parking lots by increasing the efficiency of their overall surface area. Although these opportunities would be limited in the initial stages of mixed human-driven and AV demand, potential areas of change under more widespread AV uptake could include:

- Reduced parking bay dimensions for private vehicles: Since passengers of automated vehicles would not need to exit their vehicles at the parking space (but would rather be dropped off by their car closer to the station entrance) the widths of parking bays could be reduced to the minimum dimensions needed (assuming precision side-by-side parking).
- AVs forming part of a shared fleet could be temporarily queued in a bumper-to-bumper configuration in a shared fleet staging area. In this scenario, AVs would enter the facility at one end and gradually move forward in a queue until they are called into service again.

A significant increase in kerbside access demand is expected with the uptake of AVs. Kerbside kiss and ride facilities are expected to become a common arrival/departure point at stations, and significant competition for kerbside access is likely to result. This may require kiss and ride facilities at stations to be re-designed to provide greater kerbside space, or a separate AV pickup/drop-off area could be designated preferably in a location which minimises the internal circulation of vehicles.

Next steps: Consultation with industry partners in the space of electric and autonomous vehicles should be set-up with a key focus on future station planning and catering for the needs of these future modes of transport. Specific parameters that would need to be determined would include the optimal orientation and sizing of the AV staging and drop-off/pickup areas and strategies for adapting to the ever-evolving technological advancements in electric vehicle charging.

6.2 Station development options

6.2.1 Overview of option development and time frames

Three phases of development options have been highlighted covering short (next 3-5 years), medium (10-15 years) and long (20-25 years) terms.

In the short term surplus VicTrack owned and other land is potentially available near the study stations to expand the at-grade car parking provisions to cater for additional parking demand. The potential additional at-grade parking provisions have been estimated based on retaining the existing general station parking arrangements but extending them into undeveloped land. These would be subject to site area investigations to inform the level of commuter car parking that could be provided in the identified areas.

At-grade car parking expansion opportunities have been identified at Lara, North Shore, North Geelong, Marshall and Waurn Ponds stations as discussed subsequently. There is no surplus land available near Geelong or South Geelong stations.

The medium and long terms coincide roughly with the 2031 and 2041 strategic model runs respectively but are dependent upon the rate at which changes take place with respect to travel behaviour, technological innovation, and land use within the Greater Geelong context.

Also, it is not necessarily essential for all the changes described under the medium or long term time frames to be implemented concurrently, as they could rather be staged incrementally as the need arises for specific types of vehicle accommodation based on trends and observed usage patterns. As such the precise timing of the proposed changes will be responsive to evolving conditions.

Further, at this stage of development the strategy has attempted to facilitate the park and ride demand estimates from the modelling process with the “no Geelong station parking” scenarios at 2031 and 2041 (with Geelong land use, GLU). However, expansion of these car parks should be weighed against the option of using funds to improve sustainable modes of transport as a way forward for catering for the increase in commuters at the various study stations, which would be more consistent with longer term State and City goals for the region.

The following development options therefore represent an indicative snapshot of how the full variety of access modes may be accommodated in the short (next 3-5 years), medium (10-15 years) and long (20-25 years) timeframes. The priority of this exercise, however, is to set up a design framework for each station that can readily adapt to anticipated or unexpected developments in travel demand during these time frames.

6.2.2 Lara station

Aside from Geelong, Lara represents the most complex station of the seven with respect to the diversity of existing and future demand patterns. This is due both to the variety and intensity of various land uses surrounding the station site, as well as its strategic location with respect to both current access demand and future (Northern and Western) growth areas on the outskirts of Geelong.

Table 39 projects a set of target quantities for various components of station access for the short, medium and long terms, while Figure 56, Figure 57 and Figure 58 illustrate the indicate potential spatial arrangement of these elements for each of these respective time frames.

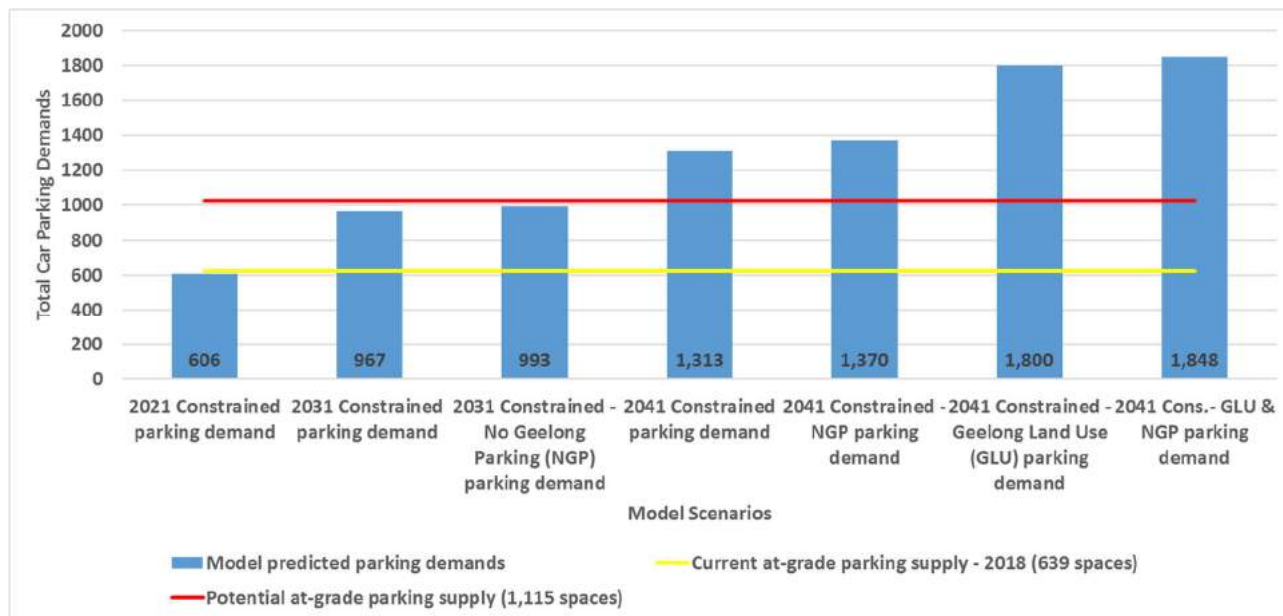
Table 39 Existing and projected station capacities by mode of access for Lara station

	Current	Short term	Medium term	Long term
General parking				
surface	575	1,025	935	537
gravel (informal)	50			
structure				1,161
Priority parking			90	90
Disabled parking	14	23	23	36
Kiss and ride	3	3	9	9
Taxi/shared			7	7
AV staging				60
Bus bays	1	1	5	5
Cycle parking	24	24	30	40

Short term: The area of land for additional at-grade parking at Lara station is shown in Figure 56 located to the north-east of the existing car parking. Some of this land is already used informally by commuters with approximately 50 cars parking on a gravel area. This is VicTrack land and would not require any re-zoning. It is estimated 450 additional formal at-grade commuter car parking spaces could be provided on this land. This would result in a total of approximately 1,025 at-grade commuter car parking spaces at Lara station.

A graph comparing the existing and potential additional at-grade commuter car parking provisions at Lara station against those projected to be required in the future under the various park and ride travel demand model scenarios is provided in Figure 55.

Figure 55 Lara station – At-grade parking provisions against future parking demand model scenarios



As shown in Figure 55 the potential at-grade car parking expansion is predicted to facilitate parking demands at Lara station up to 2031 projected parking demands. The 2041 parking demand scenarios are predicted to require additional parking above what can be provided at-grade.

Medium term: Within the next 10 to 15 years, the following changes are anticipated at Lara station, based on both the evolution of land patterns in and around Lara as well as general trends in travel behaviour and technological innovation:

- Greater use of connecting public transport, both from within the existing travel market as well as from the Northern and Western Geelong Growth Areas which are projected to begin developing within this time frame
- Greater taxi or rideshare usage, particularly given more widespread deployment of the latter
- Higher proportion of electric vehicles
- Increased arrivals by cycling and walking.

It is also important to note that Avalon Airport has begun to host international flights and is expected to continue to expand in passenger numbers into the medium term time frame. Lara station car park demand is likely to be affected as policy position evolves to utilise and further upgrade the parking infrastructure at Lara station to service a shuttle bus from Lara Station to Avalon Airport. There would be airport passengers parking at Lara station, further requiring upgrades to the bus infrastructure at Lara station and/or additional car parking space or structures.

The proposed medium term program is reflective of these changes, as well as the general increase in parking demand as projected by the travel demand model. Key features include:

- Dedication of the central-most surface parking to priority parking, which could represent any combination of electric vehicle, carpool and carshare spaces pending the rise in demand for each (Note – This area could be gradually converted to these uses from the nearest spaces outward, with the remainder continuing as general use parking until justified by demand.)
- Expansion of the bus interchange from one bay to five bays, accommodating frequency increases in current routes as well as the addition of new routes that may serve the Northern and Western Geelong Growth Areas
- Expansion of kiss and ride, taxi/rideshare, and bicycle facilities in support of general travel trends
- Formalised cycle paths and safer road crossing treatments.

Two station forecourts have also been included to collect persons arriving from various directions and to set up a framework for the longer term integrated development program.

Long term: The long term demand on Lara station (20 to 25 years) is projected by the demand forecasting exercise to necessitate construction of a parking structure. Due to the availability of footprint and proximity to the primary roads feeding the site, it is proposed that this car park be located on the site of the current south west surface lot. The demand model has suggested a need for approximately 1,848 commuter parking spaces, this is split between 537 at-grade and 1,161 spaces as part of a parking structure (the other spaces being offset to priority and AV needs) to meet the projected parking demand numbers by 2041 (with no Geelong parking).

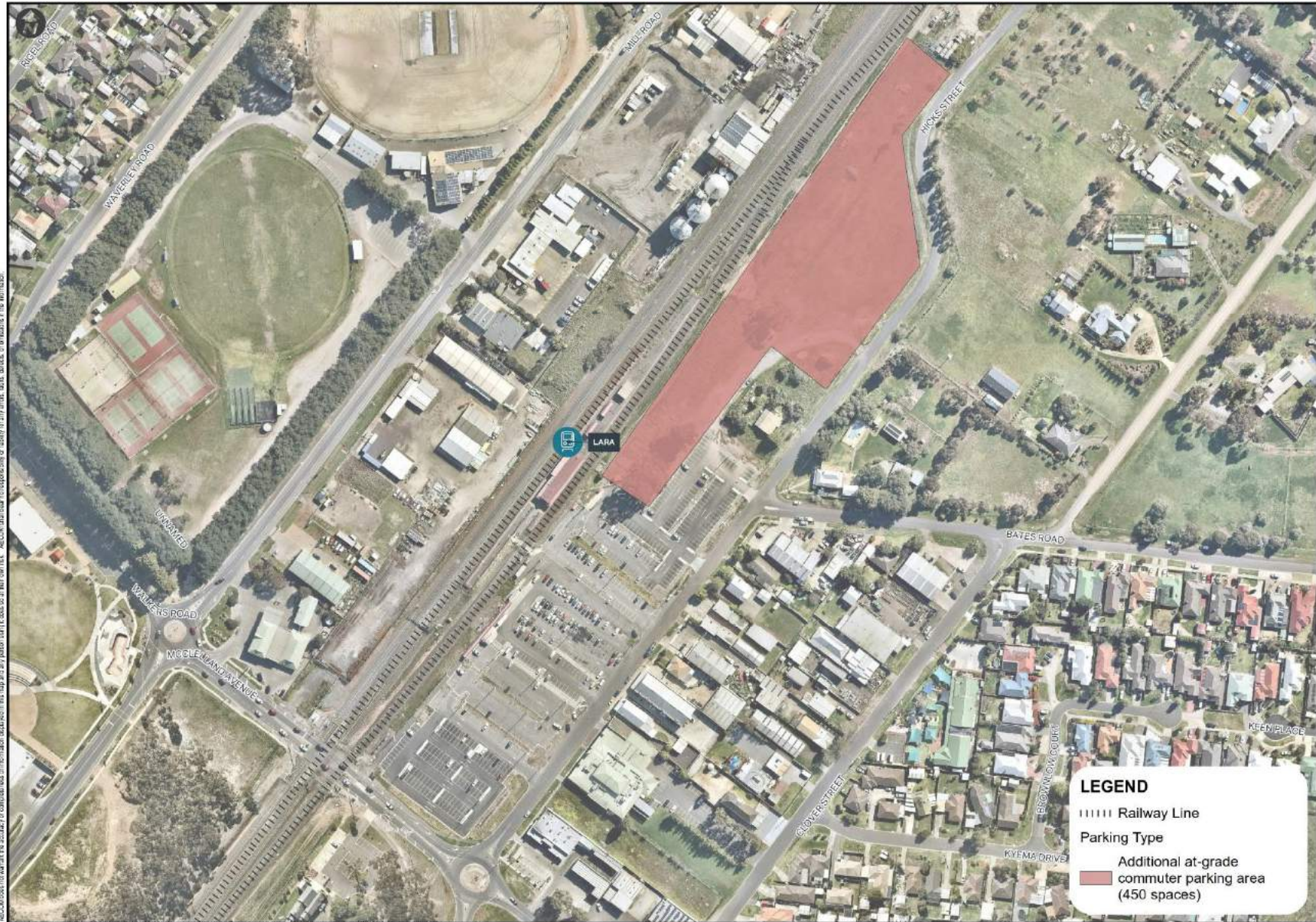
It is suggested that any parking structure at this station include ground floor retail as an amenity to commuters and to help better connect the station with its town centre surroundings.

The other major potential change in the longer term would be the conversion of the surface carpark adjacent to the bus and taxi zones into an autonomous vehicle (AV) drop-off, pickup and staging area, as it is expected that the refinement of this technology could have a large impact on daily travel decisions within this time frame. As with the other proposed features in both the short and long term, this area could remain as general or priority parking until autonomous technology has been fully integrated with the surface transport system.

Dependencies: The longer-term parking requirements for Lara station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Traffic-separated public transport through the Northern and Western Geelong Growth Areas, which could connect with Lara or an alternate station and therefore reduced the future level of parking demand projected by the model from these areas
- Commuter parking charges, which may be applicable to Lara due to its constrained nature (including traffic access) to adjust the distribution of demand along the corridor
- Public transport improvements particularly increase to the frequency of current connecting services.

Figure 56 Short term development options at Lara station



AECOM does not warrant the accuracy or completeness of the information depicted in this map and any person shall be deemed to have accepted the information at their own risk. AECOM shall bear no responsibility or liability for any errors, omissions, defects, delays or interruptions in the information.

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Figure 57 Medium term development options at Lara station



6.2.3 North Shore station

The use of North Shore station is projected to remain relatively limited into the future based on modelling forecasts, suggesting only minor adjustments in both the medium and long terms to accommodate changes in travel demand patterns. However, this conclusion could change significantly if a higher proportion of V/Line services were to stop at this station in the future during the peak periods, which may shift some of the existing demand for North Geelong and Geelong stations to North Shore station instead.

Table 40 projects a set of target quantities for various components of station access for the short, medium and long terms, while Figure 60, Figure 61 and Figure 62 illustrate the indicative potential spatial arrangement of these elements for each of these respective time frames.

Table 40 Existing and projected station capacities by mode of access for North Shore station

	Current	Short term	Medium term	Long term
General parking				
surface	63	271	254	246
gravel (informal)				
structure				
Priority parking			3	3
Disabled parking	2	8	8	8
Kiss and ride			2	2
Taxi/shared			2	2
AV staging				8
Bus bays				
Cycle parking	18	18	18	18

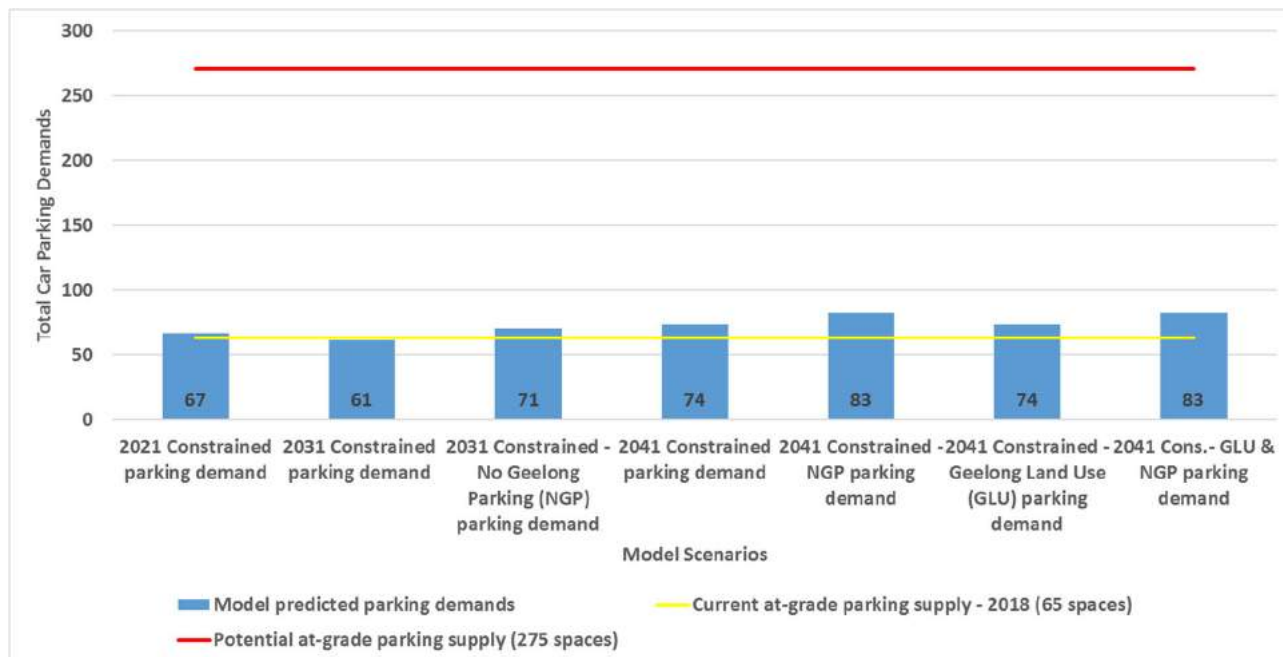
Short term: North Shore station is currently underutilised as a commuter park and ride station partially due to the limited number of trains that serve this station. However, the area does have potential for at-grade commuter car parking expansion with land free to the immediate north of the existing car park, which is vacant VicTrack land and requires no rezoning (see Figure 60).

It is estimated 206 at-grade commuter car parking spaces could be provided on this land. This would increase at-grade parking provision to 271 spaces at North Shore station.

A graph comparing the existing and potential additional at-grade commuter car parking provisions at North Shore station against those projected to be required in the future under the various park and ride travel demand model scenarios is provided in Figure 59.

Although the modelling suggests that there is no demand for parking required at North Shore station in the future, this is due to the limited number of trains that serve this station. Accordingly, with service increases North Shore station has potential to accommodate a larger portion of park and ride commuters in the future. It may be preferable to provide an additional platform access point at the northern end of the station site to avoid the need for walks of greater than 500 metres between the outermost car parks and the station platform.

Figure 59 North Shore station – At-grade parking provisions against future parking demand model scenarios



Medium term: Recommendations for the medium term could include:

- Addition of formalised kiss and ride bays consistent with other stations
- Addition of formalised taxi bays consistent with other stations
- Designation of a small priority parking area for electric vehicles, rideshare and/or carpools
- Modest adjustments to access and circulation patterns.

As North Shore is not strategically located near the termini of any major bus routes, the provision of a formal bus interchange is not anticipated as needed for either the medium or long term programs. However, the location of the northbound oriented bus stop across Station Street requires a stronger, safer pedestrian crossing treatment to more effectively integrate it with station operations. An alternative option for accommodating buses would be to use the southern portion of the existing car park as a bus staging area.

The potential need for any additional commuter car parking would be subject to further assessment and monitoring since the previously undertaken strategic modelling assessment would not have the associated rail service increases to coincide with the potential short term commuter parking increases discussed previously.

Long term: Some of the provided commuter parking would be replaced, with the potential need to integrate an AV staging area (estimated at eight spaces).

Dependencies: The parking and public transport requirements for North Shore station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Traffic-separated public transport through the Northern and Western Geelong Growth Areas, a version of which could potentially connect with North Shore station due to traffic constraints at Lara, therefore requiring a dedicated bus interchange
- Public transport improvements, particularly increases to the frequency of current connecting services, which could strengthen the need for a dedicated bus interchange.

Figure 61 Medium term development options at North Shore station



6.2.4 North Geelong station

North Geelong station is projected to have continued growth in parking demand owing to its strategic location alongside the Princes Highway. Furthermore, the split dual-sided nature of this station will make it necessary to duplicate some of the key station elements – particularly disabled parking and kiss-and-ride – on each side of the railway corridor.

Table 41 projects a set of target quantities for various components of station access for the short, medium and long terms, while Figure 64, Figure 65 and Figure 66 illustrate the indicative potential spatial arrangement of these elements for each of these respective time frames.

Table 41 Existing and projected station capacities by mode of access for North Geelong station

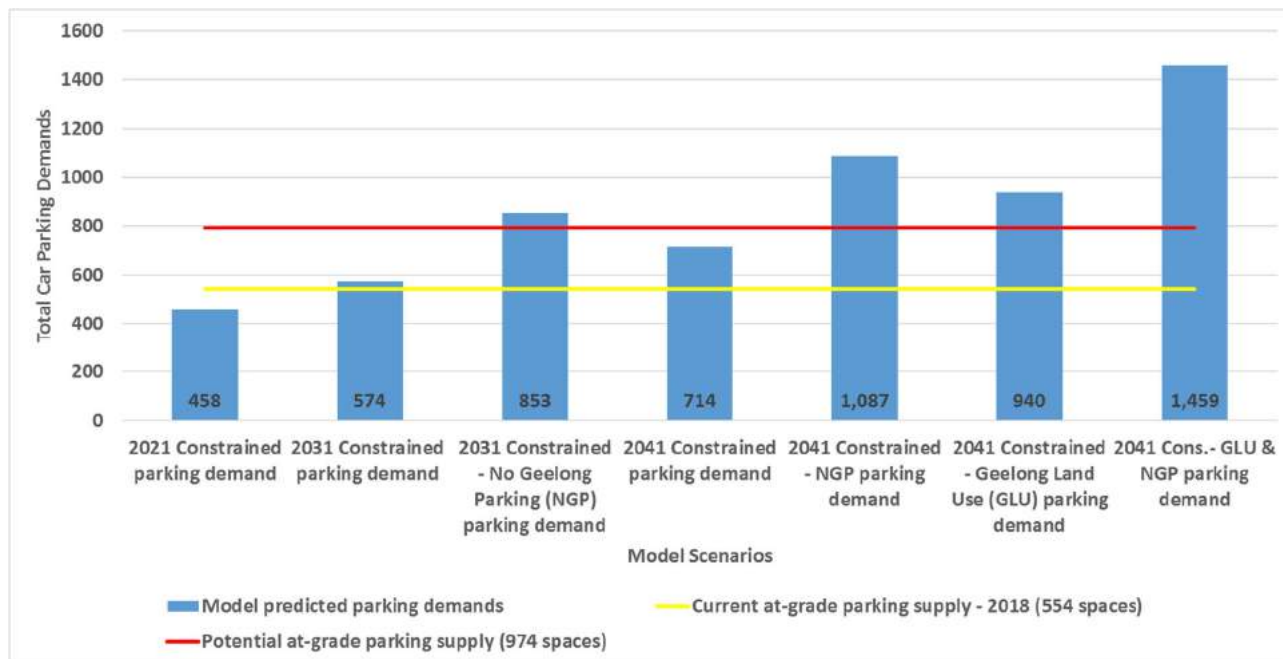
	Current	Short term	Medium term	Long term
General parking				
surface	444	794	286	
gravel (informal)	100			
structure			527	1,359
Priority parking			60	80
Disabled parking	10	18	19	30
Kiss and ride	10	10	18	18
Taxi/shared	2	2	10	10
AV staging				20
Bus bays	1	1	1	1
Cycle parking	34	34	34	40

Short term: North Geelong station currently has an informal gravel car parking area which caters for approximately 100 cars. Formalising this area may lead to a minor increase in total parking provision.

There is also vacant Department of Finance and Treasury (DFT) land near the station. This is the previous North Geelong Gasworks and currently is unused yet contaminated land. DFT were understood to be looking to repurpose this land (see Figure 64). It is estimated 350 at-grade commuter car parking spaces could be provided on this land, therefore providing a total of 794 commuter parking spaces at North Geelong station.

A graph comparing the existing and potential additional at-grade commuter car parking provisions at North Geelong station against those projected to be required in the future under the various park and ride travel demand model scenarios is provided in Figure 63.

Figure 63 North Geelong station – At-grade parking provisions against future parking demand model scenarios



As shown from Figure 63, the potential at-grade car parking expansion is predicted to facilitate parking demands at North Geelong station up to almost 2031 (with no Geelong station parking) with a shortfall of only 59 parking spaces in this scenario. Therefore, through monitoring of demands the potential at-grade proposal could facilitate parking demands up to this time period.

Parking demands are predicted to increase more significantly in 2041 under the GLU & NGP scenario, therefore triggering the need for greater commuter parking provisions (multi-deck parking structure) unless there is a significant shift toward sustainable mode access to this station.

Medium term: The sharp projected increase in demand at this station may necessitate the construction of a parking structure within 10 to 15 years pending on the outcome of local land utilisation in the short term (a review would have to be made as to the best use of available land). As shown, a parking structure would be optimally located at the southern end of the station site closest to Victoria Street to avoid unnecessary levels of internal circulation. A ground-level retail storefront is suggested for the south east corner of the structure to provide an additional amenity for the majority of arriving and departing passengers.

This key element is proposed to be supported in the medium term by the following:

- Reclassification of the southernmost car park (i.e. south of Victoria Street) as a priority parking area for electric vehicles, carpools and carshare as appropriate, together with a strip of parking directly adjacent the tracks on the east side of the rail corridor
- Formalisation of the entrance to the platform access path as a station forecourt
- Expansion of kiss and ride facilities including their installation on both sides of the rail corridor
- Expanded taxi zone on the east side of the rail corridor
- Increase in disabled parking spaces and their inclusion on both sides of the rail corridor.

The nature of the bus services in this area – along with the station configuration – do not suggest that a formal bus interchange would be a key requirement at this station. However, improvement to the quality of the connectivity to the southbound oriented bus stop across Princes Highway will be required if connecting bus patronage is to be grown at this location. A further option would be to include an off-street bus interchange as part of the development of a parking structure on the west side of the railway; however, this would require a significant diversion of bus routes to access the new facility. That being said, North Geelong station is strategically located in proximity to the Midland Highway and has the potential to be a key linkage from the Western Geelong Growth Area, so the inclusion of a

formal off street bus interchange at North Geelong station could increase in importance particularly if new bus routes are implemented to directly connect the growth area with the station.

Long term: As the long term is projected to see a continued increase in parking demand at North Geelong station, a further increment in structured parking may need to be provided. It is suggested that this take the form of a second parking structure to the north of the first, for the purposes of maintaining the majority of the parking supply while the additional parking is being constructed. If this were to be the case, it may also be necessary to provide a second access path to the platforms, potentially in the form of a bridge emanating directly from the new parking structure.

This new access path could continue fully across the corridor to land in an eastern station forecourt established to collect passengers from a newly established AV staging zone on the east side of the station adjacent to Princes Highway.

Dependencies: The longer term parking requirements for North Geelong station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Commuter parking charges, which may be applicable to North Geelong station to help shift a portion of its demand to nearby North Shore station
- Public transport improvements, particularly increases to the frequency of current connecting services which may require a stronger approach to accommodating transfers at this location.

Figure 65 Medium term development options at North Geelong station



Figure 66 Long term development options at North Geelong station



6.2.5 Geelong station

A priority short-term action in the Revitalising Central Geelong Action Plan was to develop a parking strategy that will deliver on the action “to develop a commuter parking strategy for train stations within Geelong to reduce all day commuter parking in central Geelong over time”.

At the time of preparation of this report, the Geelong Fast Rail was not a publicly known and funded announcement nor commitment. Therefore, this study has not considered the GFR project.

Development Victoria have developed a medium/long term indicative layout for Geelong station which is provided in Figure 68. This shows at a high level the removal of car parking at the station and land used for future to be determined development. The layout also proposes relocation of the bus interchange to the north.

Table 42 projects a set of target quantities for various components of station access for the short, medium and long terms. These will need to be considered in the subsequent master planning process for Geelong station and the indicative proposals as part of the layout provided in Figure 68 by Development Victoria.

Table 42 Existing and projected station capacities by mode of access for Geelong station

	Current / Short term	Medium term	Long term
General parking			
surface	505		
gravel (informal)			
structure			
Priority parking		40	
Disabled parking	4	12	12
Kiss and ride	12	24	24
Taxi/shared	6	12	12
AV staging			80
Bus bays	11	11	15
Cycle parking	62	200	260
Motorcycle parking	8	16	24

Short term: There is no surplus land available near Geelong station. Also, the development of this strategy has acknowledged the goal of reducing all day commuter parking at Geelong station. For completeness of comparison a graph showing the existing car parking provisions at Geelong station against those projected to be required in the future under the various strategic model scenarios is provided in Figure 67.

Figure 67 Geelong station – At-grade parking provisions against future parking demand model scenarios



As shown from Figure 67, under the various “no Geelong commuter parking” scenarios parking demand would be shifted to other stations along the corridor. A key consideration will be the timing of the reduction of commuter parking at Geelong station and the potential impacts of additional demand in the interim, as shown parking demands are predicted to increase under the scenarios if parking is still permitted.

Medium term: It is likely that at Geelong station over the next 10 to 15 years all commuter car parking will be removed, according to the goals established by the *Revitalising Central Geelong Action Plan*. However, the act of doing so would rely on further use of taxi, rideshare and kiss-and-ride as modes of arrival. As such the areas for accommodating these will need to be considered for expansion, with the doubling of the size of their current facility.

Ideally the remainder of the general use spaces within this car park (if not altogether converted to another use) would be reallocated to priority parking for electric vehicles, carpools or carshare.

The future of the western car park is dependent on wider objectives for the station area and is assumed to be transitioned to an alternate use by the medium and longer term. It is acknowledged that as part of this study, V/Line does not endorse/support the removal of car parks on the western side of the station except through any future unknown formal Government announcement.

The proposed reduction over time of commuter car parking at Geelong Station is also projected to lead to a sharp rise in the number of daily arrivals by bicycle, with projections in the order of 200 and 260 in 2031 and 2041, respectively, which cannot be fully accommodated within the existing cage, loops and spirals which total 62 spaces. As such, a key component of the medium term program will be expansion of the existing cycle parking area and/or the addition of a new cage in a location potentially carved out of the vacated general use spaces.

Long term: The long term program at Geelong Station is likely to incur the following further changes:

- Further addition of cycle parking to support 200 to 260 cyclist’s dependent on observed demand
- Establishment of a sizeable AV staging zone convenient to the station entrance, likely the largest such facility needed within the study area due to the complexity of two-way arrivals and departures for travel along the railway in both directions for various purposes.

The sizing and location of the AV zone – as well as any remaining kiss and ride or disabled parking functionalities – would be informed by the full site development program as it progresses.

Dependencies: The longer term outcome for Geelong station will be influenced by a number of additional factors:

- Follow-up to the *Revitalising Central Geelong Action Plan* particularly as it pertains to the specific design elements and urban design objectives of Geelong station
- Orientation of future new public transport services (*Western Rail Plan*) that may converge on Geelong station as the primary regional transport hub
- Any additional public transport improvements that may require the expansion or re-siting of the existing bus interchange.

Figure 68 Geelong station 10-15 year potential layout



Source – Development Victoria

6.2.6 South Geelong station

Due to the extensive residential area that surrounds it, South Geelong station is projected to have a high level of parking required into the future despite that it also sits within an established city neighbourhood context. As such, accommodating the additional parking at this location will require a careful design approach that balances the basic functional access requirements with their visual and contextual impacts including within the Urban Design Framework. This study investigates the gap between available capacity and projected demand at stations and managing the shortfall in commuter car parking will need to be further informed from outside this study in a strategic policy development setting.

South Geelong, Marshall and Waurn Ponds stations are proposed to be upgraded as part of the Geelong to Waurn Ponds Railway Infrastructure Upgrade Project (IUP). In addition, the rail line duplications other works include new stations, parking provision and accessibility improvements. The timing of this project is not known at this stage but has been assumed to occur in the medium term, accordingly proposals in this strategy need to be discussed and refined as necessary with key stakeholders to ensure a consistent upgrade of commuter provisions at these stations.

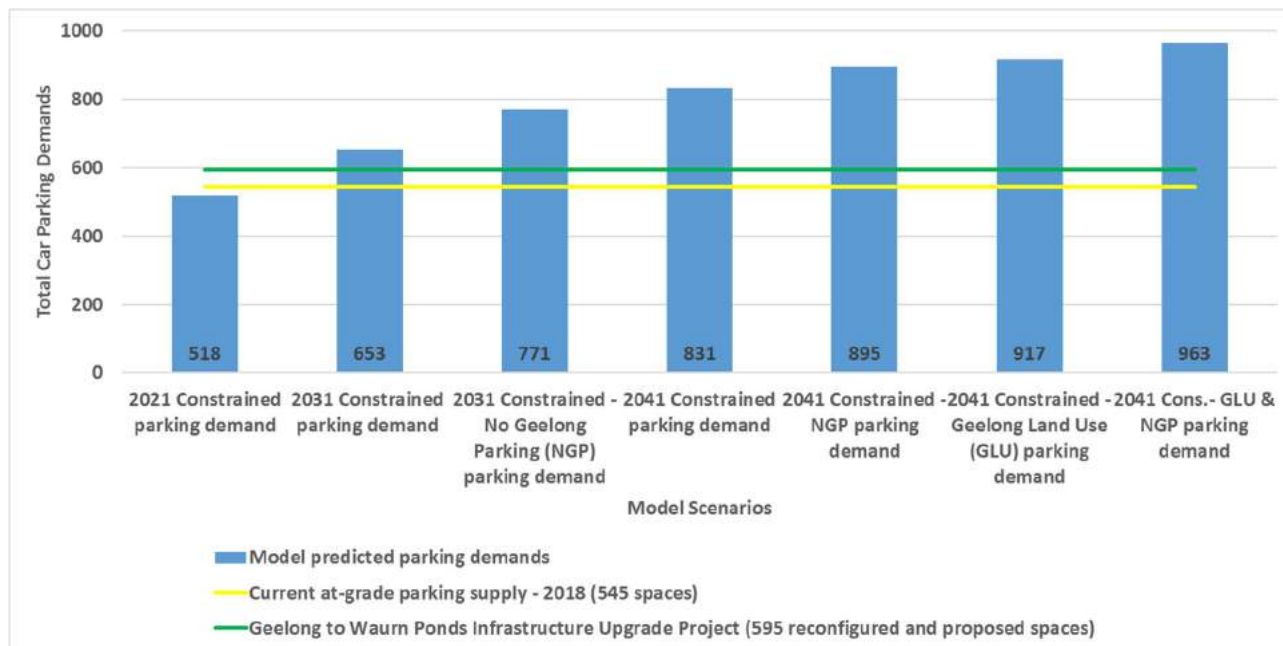
Table 43 projects a set of target quantities for various components of station access for the short, medium (including IUP provisions) and long terms, while Figure 70 and Figure 71 illustrate the indicative potential spatial arrangement for the medium and longer term proposals.

Table 43 Existing and projected station capacities by mode of access for South Geelong station

	Current / Short term	Medium term		Long term
		IUP project	Commuter strategy	
General parking				
surface	545	595	432	335
gravel (informal)				
structure			327	492
Priority parking			12	100
Disabled parking	8	13	18	22
Kiss and ride	5	19	19	19
Taxi/shared	5	4	7	7
AV staging				60
Bus bays	3	3	3	3
Cycle parking	62	62	75	75

Short term: There is no surplus land available near South Geelong station. A graph comparing the existing car parking provisions at South Geelong station against those projected to be required in the future under the various strategic model scenarios is provided in Figure 69. The graph also shows where the IUP project proposed parking provisions would align with predicted parking demands.

Figure 69 South Geelong station – At-grade parking provisions against future parking demand model scenarios



As shown from Figure 69, parking demand at South Geelong station is predicted to exceed supply in all future model scenarios. Given that there is no free land to increase parking supply a multi-deck parking structure would have to be considered at South Geelong station (with notable increases under the “no Geelong station commuter parking” scenarios) unless there is a significant shift toward sustainable mode access to the station.

Medium term: Medium term changes at South Geelong station are proposed to include the following:

- Addition of a parking structure on the rectangular tract along Verner Street, including ground-level retail in the corner nearest the station. This would also need to be consistent with the Urban Design Framework as well as the vision for the upgrade of the station as part of the South Geelong to Waurm Ponds rail track upgrade. This study investigates the gap between available capacity and projected demand at stations, however managing the shortfall in commuter car parking will need to be further informed from outside this study in a strategic policy development setting. The car park could be built to satisfy future requirements up to 2041 if deemed applicable, however any provision would need to take into account offsets from on-street local parking demands.
- Expansion and relocation of the kiss-and-ride accommodation
- More efficient arrangement of the taxi staging area
- Improved pedestrian crossing treatment across Yarra Street outside the western station entrance (connecting to the bus bay on Lonsdale Street)
- Expansion and upgrade of the cycle parking, along with the establishment of formal access pathways from both the east and the south/west
- Reorganisation of the parking into defined sub-areas suited to incremental conversion to other uses
- Moderate reorganisation of internal circulation patterns
- Opening of the access drive from Swanston Street to avoid unnecessary growth in traffic levels on Foster and Bellerine Streets and avoid circulation.
- Designation of a priority parking area near the access points to the platform.

Long term: Long term changes at South Geelong station are proposed to include the following:

- Designation of further priority parking spaces on the surface car park adjacent to the rail corridor
- Conversion of the parking area adjacent the taxi and bus zones into an AV drop-off, pickup and staging area, with an additional area provided in the south-eastern parking area at the expense of general parking provision..

Dependencies: The longer term parking requirements for South Geelong station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Commuter parking charges, which may be applicable to South Geelong station to help shift a portion of its demand to other stations and other travel modes
- Public transport improvements, particularly increases to the frequency of current connecting services which may require a stronger approach to accommodating transfers at this location.

In addition, the off-street parking requirements at South Geelong station would be significantly impacted by redevelopment of the Barwon Water site on the north side of the rail corridor, in which case this land would be used for high value purposes, such as mixed use development. Under this scenario, much of the on-street parking which currently supports car access at South Geelong would presumably no longer be available to commuters (or its availability would be diluted by the competing demands of office workers). If this project were to proceed, some of the proposals may need to be accelerated (particularly the parking structure) unless a significant proportion of the station access demand could be effectively shifted to alternate modes.

Figure 70 Medium term development options at South Geelong station



Figure 71 Long term development options at South Geelong station



6.2.7 Marshall station

The rapidly developing area to the south east of Marshall station is projected to lead to a significant increase in the demand for parking at this station with continued growth over the next 25 years. While the available land for further parking is generous, the forecasting results suggest that at least one parking structure will be needed on this site to accommodate future demand.

It is understood that City of Greater Geelong is undertaking a Marshall Precinct Structure Plan (PSP) which is in the consultation stage. The initial outlined goals include creation of a walkable, interactive and well-designed neighbourhood that uses the potential of Marshall station and surrounding land. Therefore, the proposed expansion of commuter car parking would be at odds with this PSP goal and consequently co-ordination with Council to the commuter parking requirements will be required. The City of Greater Geelong envisions Marshall station being developed as a Transit Oriented Development (TOD). Should this eventuate any additional commuter car parking would likely be viewed unfavourably.

In addition, South Geelong, Marshall and Waurn Ponds stations are proposed to be upgraded as part of the Geelong to Waurn Ponds Railway Infrastructure Upgrade Project (IUP). In addition, the rail line duplication other works include new stations, parking provision and accessibility improvements. The timing of this project is not known at this stage but has been assumed to occur in the medium term, accordingly proposals in this strategy need to be discussed and refined as necessary with key stakeholders to ensure a consistent upgrade of commuter provisions at these stations.

Table 44 projects a set of target quantities for various components of station access for the short, medium and long terms, while Figure 73, Figure 74 and Figure 75 illustrate the indicative potential spatial arrangement of these elements for each of these respective time frames.

Table 44 Existing and projected station capacities by mode of access for Marshall station

	Current	Short term	Medium term		Long term
			IUP Project	Commuter Strategy	
General parking					
surface	378	1,180	547	1,302	812
gravel (informal)	55	55			
structure					657
Priority parking				70	60
Disabled parking	7	7	13	12	12
Kiss and ride	12	12	12	15	15
Taxi/shared	1	1	3	10	10
AV staging					10
Bus bays	3	3	3	3	3
Cycle parking	29	29	29	40	50

Short term: The most suitable land to be potentially used for future commuter at-grade car parking is to the east, west or south of the existing southern carpark, as this land is owned by VicTrack. However it should be noted that this land is currently zoned as UGZ – Urban Growth (see Figure 73).

Some of the identified land is already used informally as parking with space for approximately 55 cars. It is estimated that 802 at-grade commuter car parking spaces could be provided on this land.

A graph comparing the existing and potential additional at-grade commuter car parking provisions at Marshall station against those projected to be required in the future under the various park and ride travel demand model scenarios is provided in Figure 72. The graph also shows where the IUP project proposed parking provisions would align with predicted parking demands.

Figure 72 Marshall station – At-grade parking provisions against future parking demand model scenarios



As shown from Figure 72, the potential at-grade car parking expansion is predicted to facilitate parking demands at Marshall station up to the 2031 parking demand scenario. However, under the 2031 “no Geelong station commuter parking” scenario and the future 2041 model scenarios, the additional at-grade parking supply will not be able to cater for the projected parking demands. Accordingly, a multi-deck parking structure would be required, however this would be subject to local planning objectives (i.e. the PSP) and any sustainable mode shift initiatives to reduce commuter parking demands across the network.

Medium term: With the projected growth in parking demand over the next 10 to 15 years, the following measures are recommended for Marshall Station:

- Parking demands can be met by at-grade provisions when the IUP project car park to the west of the station is built; however, land take and usage would need to be reviewed, in which case a parking structure may be required.
- Direct connection to Drews Road from the southern carparks, plus sealing and upgrading of Drews Road south of Orpington Crescent to Reserve Road as an alternate access route
- Traffic calming treatments on Drews Road between Marshalltown Road and Orpington Crescent to prevent this section of residential street from becoming a cut-through conduit to the southern station access point
- Designation of an expanded formalised taxi/rideshare zone adjacent to the disabled parking
- Expansion of cycle parking and construction of a cycling or shared use access path from Drews Road alongside the proposed new station entrance.

Long term: The long term parking demand for Marshall Station is projected to continue to rise with the ongoing increase in residential population within the station’s driving catchment, which may necessitate the expansion of the need for expansion or a secondary parking structure. A staging area for autonomous vehicles would also be expected to be needed in the long term, although the proportion of arrivals by this mode of transport is likely to be lower than that for other stations further north due to the single-use nature of most of the surrounding land area.

Furthermore, in the longer term an expansion of the bus interchange may be required to support an increase in services throughout its connecting bus catchment. This would be particularly important if a bus rapid transit (BRT) option were chosen for future service along the Armstrong Creek and Torquay

corridor. If expansion of the interchange were required, this could occur in any of the following configurations depending on space requirements and co-ordination with the IUP project:

- Along the south east kerbing of the existing access loop (adjacent to the northernmost portion of the existing large carpark)
- Into the rectangular tract of land directly south of the existing bus loop (also within the VicTrack boundary)
- By reconfiguring the existing bus staging area adjacent the station entrance into a more efficient sawtooth configuration to include an additional 2 to 3 bus bays.

Dependencies: The longer term parking requirements for Marshall station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Outcome and timing of the Torquay (Armstrong Creek) public transport corridor initiative
- Additional public transport improvements, which may require expansion of the bus interchange as discussed above
- Shared path along the South Geelong to Waurn Ponds corridor as part of its duplication, which could significantly enhance the options for local non-motorised access from nearby residential areas.

It should also be noted that some of the land near the station could potentially be suited to medium density residential development which could assist in reducing its reliance on private motor vehicles. Incorporation of this type of development would represent a paradigm shift for Marshall station that may lead to a wider de-emphasis of car based access.

Figure 73 Short term development options at Marshall station



Figure 74 Medium term development options at Marshall station



Figure 75 Long term development options at Marshall station



6.2.8 Waurm Ponds station

Waurm Ponds station serves a rapidly growing residential catchment south west of Geelong, yet in its current form is entirely contained on the northern side of the railway corridor. As the VicTrack reserve does not encompass the expansive vacant land on the south side of the corridor it is unclear whether any near term parking expansion could occur there, yet pedestrian connections across the corridor should be strongly considered to better connect the station with any land uses that may emerge along Baanip Boulevard which would be very well within the walking catchment of the station.

In addition, South Geelong, Marshall and Waurm Ponds stations are proposed to be upgraded as part of the Geelong to Waurm Ponds Railway Infrastructure Upgrade Project (IUP). In addition, the rail line duplications other works include new stations, parking provision and accessibility improvements. The timing of this project is not known at this stage but has been assumed to occur in the medium term, accordingly proposals in this strategy need to be discussed and refined as necessary with key stakeholders to ensure a consistent upgrade of commuter provisions at these stations.

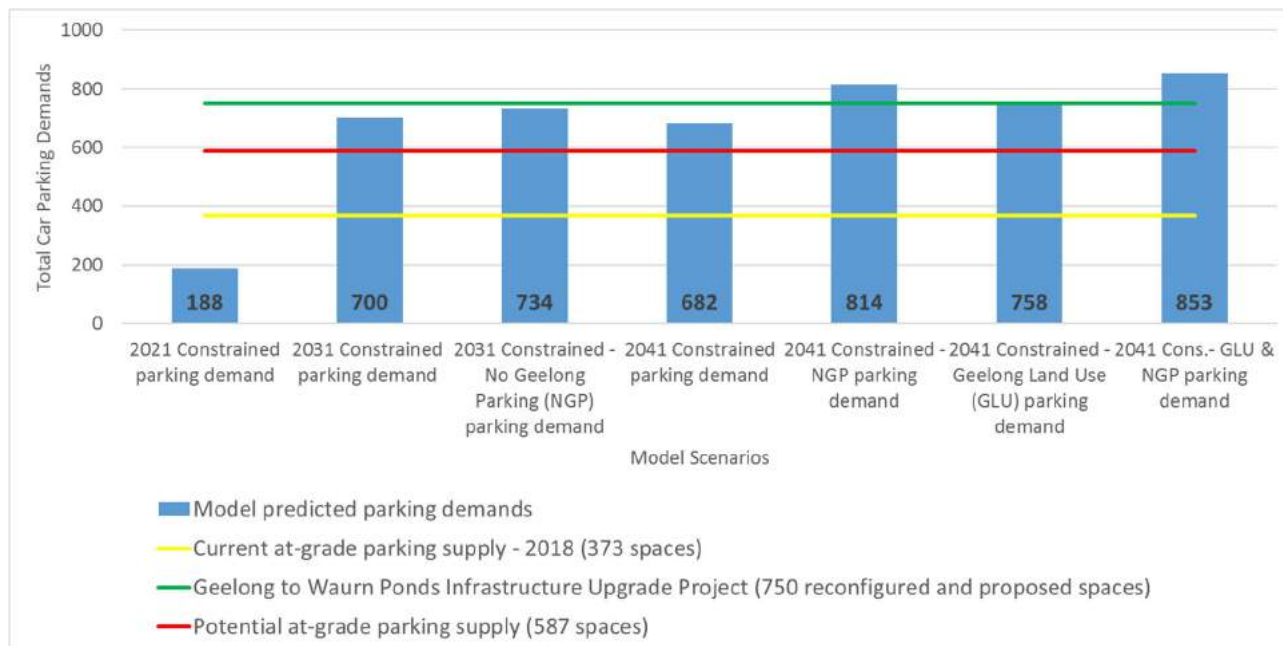
Table 45 projects a set of target quantities for various components of station access for the short, medium and long terms, while Figure 77, Figure 78 and Figure 79 illustrate the indicative potential spatial arrangement of these elements for each of these respective time frames.

Table 45 Existing and projected station capacities by mode of access for Waurm Ponds station

	Current	Short term	Medium term		Long term
			IUP Project	Commuter Strategy	
General parking					
surface	279	587	750	750	860
gravel (informal)					
structure					
Priority parking				20	20
Disabled parking	5	14	15	15	7
Kiss and ride	7	7	5	12	12
Taxi/shared			3	5	5
AV staging					20
Bus bays	2	2	2	2	2
Cycle parking	30	30	30	30	45

Short term: The most suitable land to be potentially used for future commuter at-grade car parking is to the east of the existing carpark, as this is VicTrack land and requires no rezoning. This land is already used informally by commuters to park, with approximately 89 vehicles observed to park. It is estimated that 308 at-grade commuter car parking spaces could be provided on this land, therefore increasing commute parking provision to 587 spaces.

A graph comparing the existing and potential additional at-grade commuter car parking provisions at Waurm Ponds station against those projected to be required in the future under the various park and ride travel demand model scenarios is provided in Figure 76. The graph also shows where the IUP project proposed parking provisions would align with predicted parking demands.

Figure 76 Waurn Ponds station – At-grade parking provisions against future parking demand model scenarios

As shown from Figure 76, the potential at-grade car parking expansion cannot facilitate fully the predicted future commuter parking demands at the station, therefore requiring the additional parking area proposed as part of the IUP project to the south of the station to meet the 2031 (with no Geelong commuter parking) scenario.

Medium term: As shown in the previous analysis tables and graphs the IUP improvements works will aid to facilitate the medium term parking requirements at Waurn Ponds station (this includes the additional station parking to the south of the station).

Other medium term initiatives may include expansion of the kiss and ride area and introduction of a formal taxi/rideshare zone, plus the potential conversion of the central-most section of parking to a priority vehicle area (electric cars, carshare and carpools).

Long term: Long term initiatives could include:

- Additional at-grade car parking to meet projected 2041 parking demands on vacant land to the west of the southern proposed IUP car park.
- Introduction of an AV drop-off, pickup and staging area, noting that (as with Marshall Station) the shift to this emerging mode of transport would probably be slower than that at most of the stations further north given a homogenous surrounding land use pattern and unidirectional demand.

Dependencies: The longer term parking requirements for Waurn Ponds station may be significantly affected by several of the strategic initiatives discussed in Section 6.1:

- Outcome and timing of the Torquay (Armstrong Creek) public transport corridor initiative, which may provide alternate park and ride opportunities for the southernmost portions of the Waurn Ponds driving catchment
- Additional public transport improvements, which may require consolidation, relocation and expansion of the bus interchange as discussed above
- Shared path along the South Geelong to Waurn Ponds corridor as part of its duplication, which could significantly enhance the options for local non-motorised access from nearby residential areas.

Figure 77 Short term development options at Waurm Ponds station

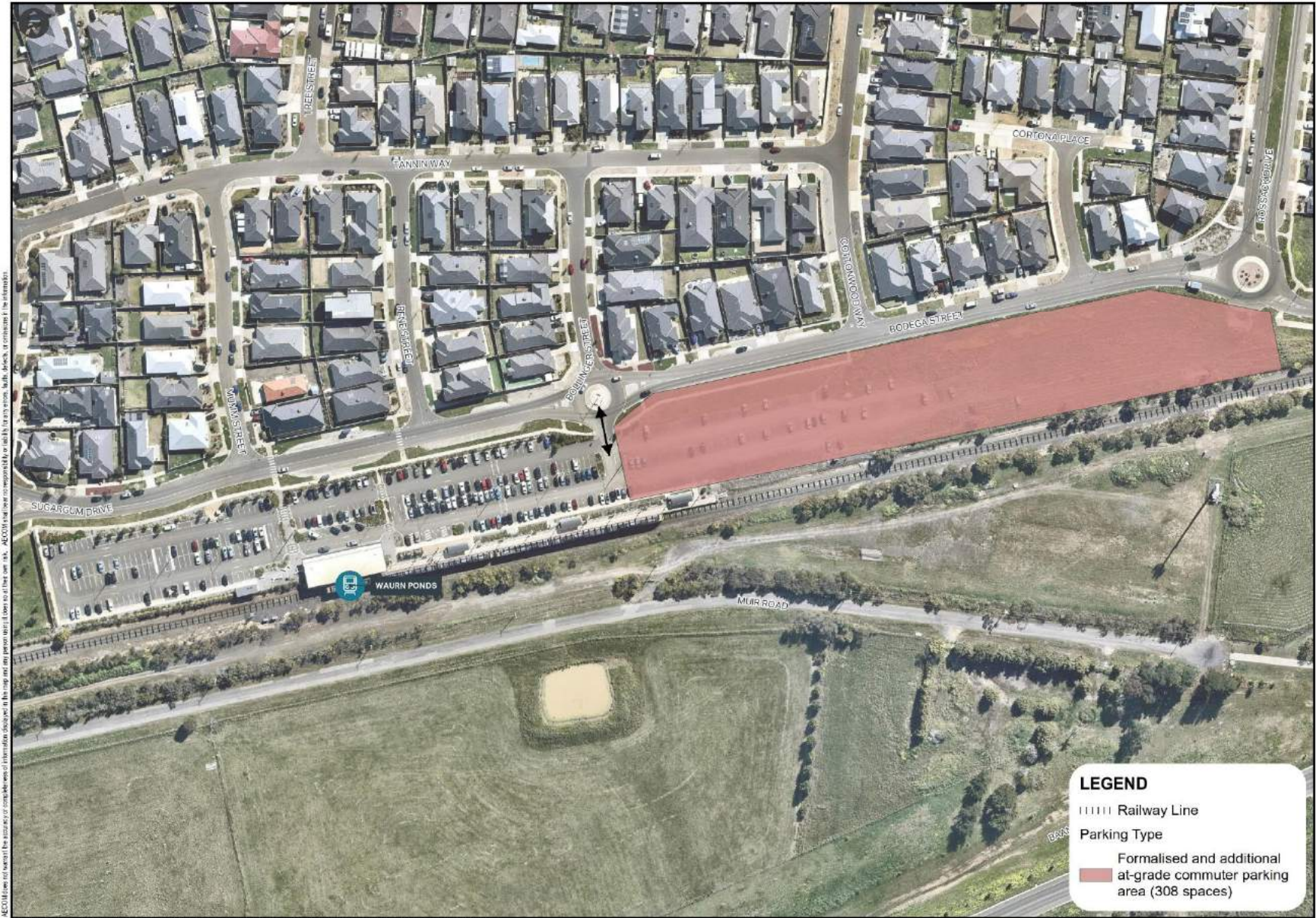


Figure 78 Medium term development options at Waurm Ponds station

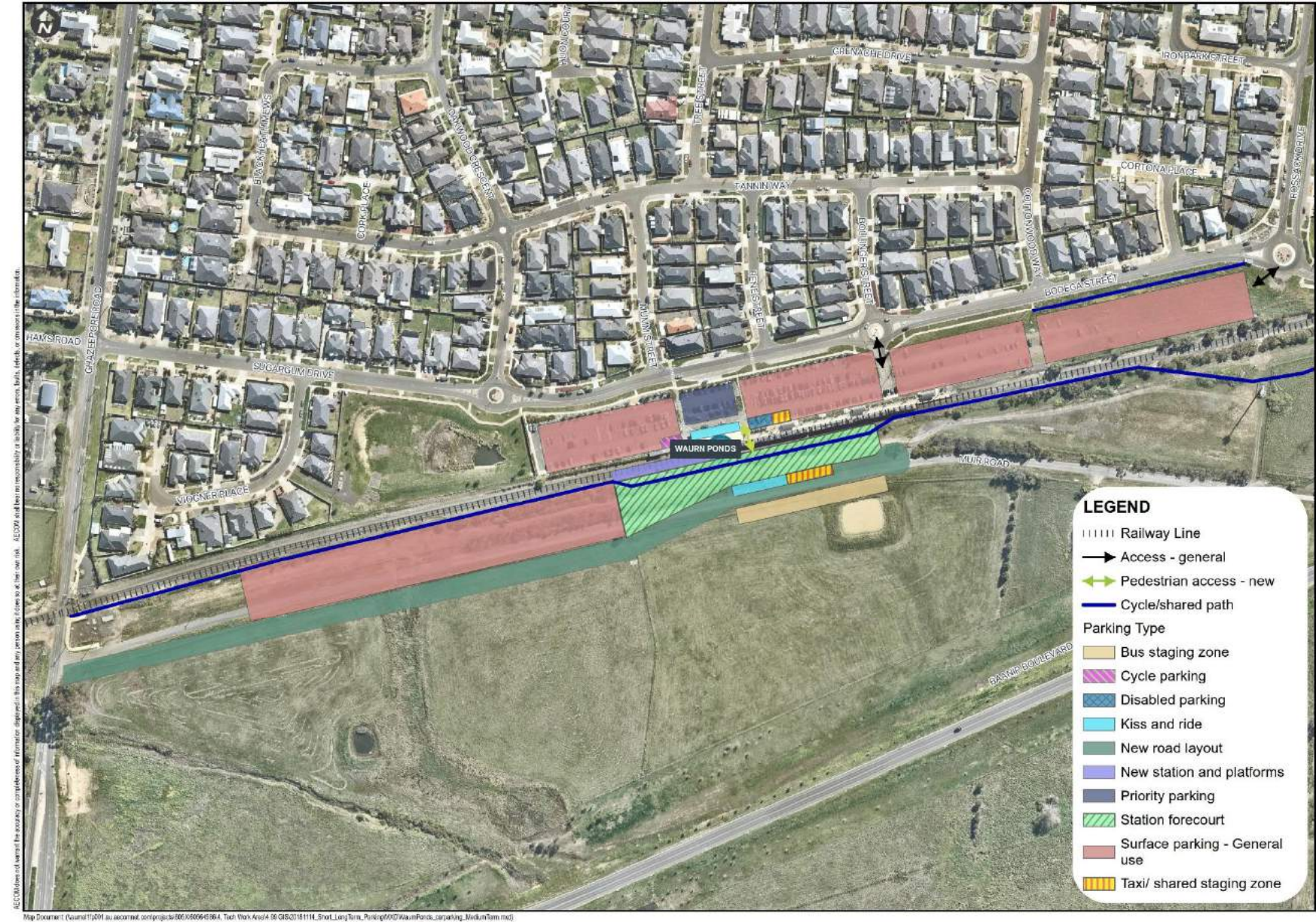
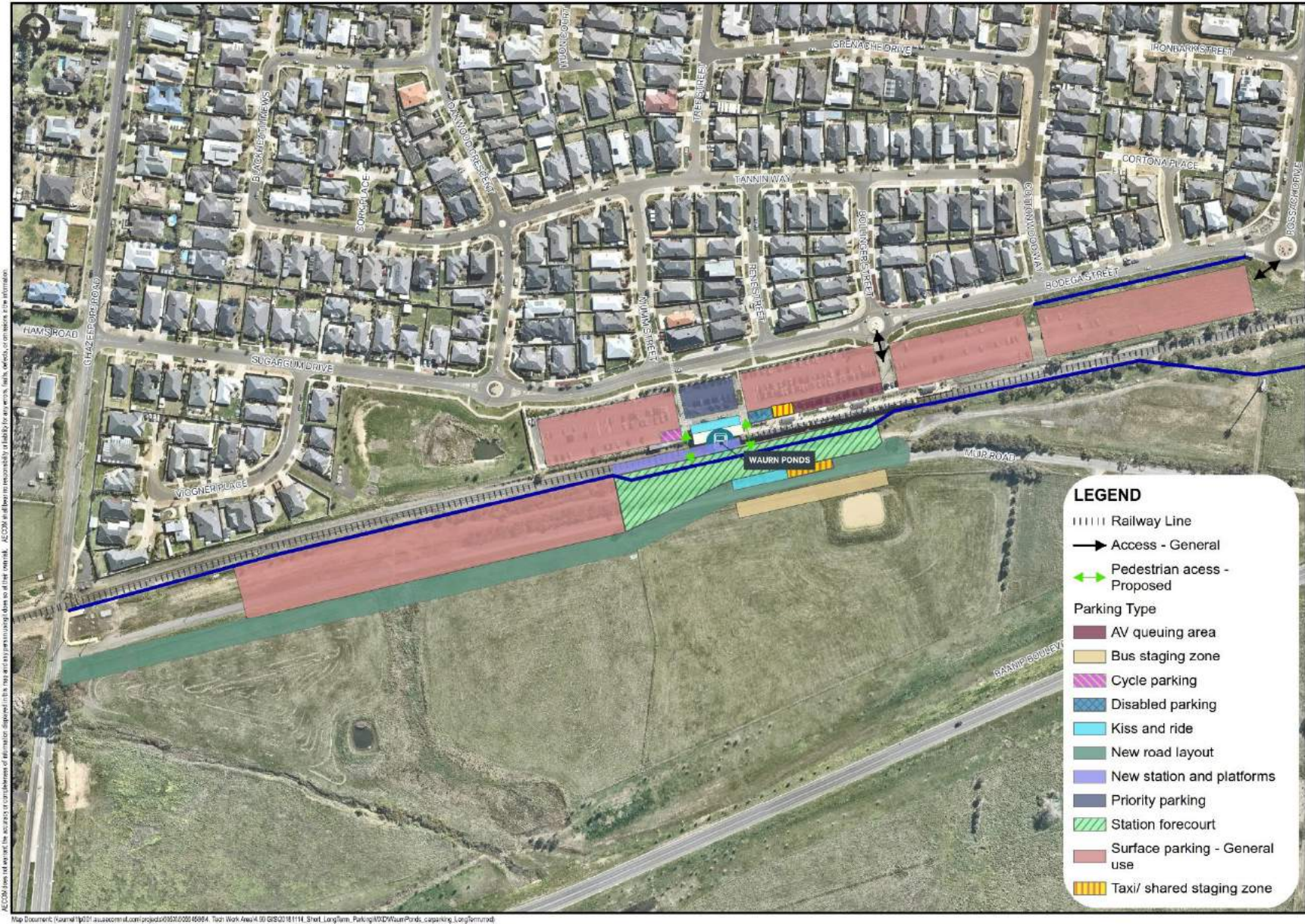


Figure 79 Long term development options at Waurn Ponds station



6.3 Other considerations

6.3.1 Cost estimates

Table 46 shows high level cost estimates for the potential short term car parking expansion projects previously outlined for Lara, North Shore, North Geelong, Marshall and Waurn Ponds.

Appendix H provides full details of the cost estimating exercise including methodology, itemised cost elements, and exclusions.

It should be noted that improvement costs associated with Marshall and Waurn Ponds may not be logical and should be reviewed in the context of the improvement works as part of the IUP project where station facilities and parking areas to be improved and expanded.

Table 46 High level cost estimates for short term car parking expansion

STATION	SITE AREAS (m2)			CAR PARKING (no)				TOTAL COST
	Existing	Proposed addition	TOTAL AREA	Existing spots (surfaced)	Existing spots (gravel - to be formalised)	Proposed addition	TOTAL SPOTS	
LARA	13,100	20,900	34,000	589	50	490	1,129	\$10,762,328
NORTH SHORE	11,000	5,000	16,000	65	0	206	271	\$7,572,820
NORTH GEELONG	13,500	24,500	38,000	454	100	420	974	\$14,755,553
MARSHALL	28,000	13,500	41,500	392	55	750	1,197	\$18,619,744
WAURN PONDS	12,500	10,500	23,000	284	89	281	654	\$9,592,198
							TOTAL	\$61,302,644

6.3.2 Station infrastructure and facilities

Based on commuter feedback and site observations many of the existing station infrastructure and facilities would benefit from a detailed review in the form of infrastructure and accessibility audits to assess the whole of journey experience, and the potential improvements that could be made. Some considerations for each respective study station are outlined in Table 47.

Table 47 Potential station improvements

Station	Potential improvements
Lara	<ul style="list-style-type: none"> - More seating for commuters - More and better toilet facilities
North Shore	<ul style="list-style-type: none"> - Shelter provided at the station - More and better toilet facilities - Bicycle lockers - Improve safety, links to and from station
North Geelong	<ul style="list-style-type: none"> - Shelter provided at the station - More seating for commuters - Review Myki reader provision - Bicycle lockers - Improve safety, links to and from station, notably underpass

Station	Potential improvements
Geelong	<ul style="list-style-type: none">- More and better toilet facilities- Accessibility to the station
South Geelong	<ul style="list-style-type: none">- More seating for commuters- Improve safety, links to and from station
Marshall	<ul style="list-style-type: none">- Shelter provided at the station- Improve safety, links to and from station- More seating for commuters
Waurm Ponds	<ul style="list-style-type: none">- More seating for commuters- Improve safety, links to and from station- More and better toilet facilities

7.0 Recommendations and next steps

7.1 Medium term approach

The strategic longer term outlook for most of the stations along the Geelong corridor calls for the maximisation of the use of alternate access modes as the most promising means to efficiently grow patronage. However, these are dependent on a number of additional infrastructure and contextual improvements that will occur over time, leaving much of the short term demand to be accommodated through additional parking.

Although on the surface the proposed development option approaches seem contradictory, the structuring of the short and medium term parking expansions to be convertible to other uses can allow for a smooth transition to the longer term intentions as substantial travel behavioural changes are enabled. This could be accomplished through incorporation of flexibility in the design details, including:

- Structuring of parking areas to conform to regularised parcel footprints, to allow for its incremental redevelopment into other land uses without having to rearrange the remainder of the parking
- Maximisation of access points to/from the surrounding road network, to accommodate future separation of station versus non-station traffic as parts of the parking allotment is converted to other uses.

Potential uses in the longer term could include:

- Other transport related operations such as expanded bus interchanges or designated autonomous vehicle staging areas
- Public spaces to serve as station forecourts or community amenities, particularly in areas with an increasing density in population or service provision.
- Shops, offices, apartments, community centres or other built uses, which could be incrementally added on a parcel by parcel basis if the medium term parking areas are arranged to allow it
- Parking structures, particularly at stations where car access will continue to make up a large portion of station demand due to the nature of the surrounding context.

In summary, due to the many dependencies for effecting travel behavioural change for which precise dates cannot be accurately determined, the main recommendation for the short term is to accommodate short term patronage demand through strategic surface car parking expansions organised to be readily convertible to other uses as conditions evolve.

7.2 Corridor wide guidelines

Just as the short and medium term works should not be designed as to preclude eventual conversion to other uses, neither should the longer term parking structure options. Rather all parking structures should be designed to the following general guidelines to ensure that any such major facility does not have an irreversible or negative impact on the potential to eventually shift commuters to alternate modes of access:

- Incorporation of ground floor retail spaces particularly along significant pedestrian movement corridors
- Structural standards and foot prints consistent with eventual conversion to other building uses.

An example of potential changes to parking policy to support adaptability of parking facilities is currently under consideration by Melbourne City Council. This change would require structured above-ground parking to incorporate minimum 3.5 metre floor-to-floor heights, flat floorplates or stacker systems appropriate for future retrofit to alternate uses, as stipulated in the Central Melbourne Design Guide, City of Melbourne (June 2018). Structural, mechanical, electrical, plumbing, geotechnical, and fire resistance considerations are all required in the planning of new parking structures.

The overall purpose of introducing these types of flexible development guidelines is to address the potential longer term decrease in off-street commuter parking demand expected to occur as a result of increasing AV uptake, the rate and timing of which remains largely unknown. Creating facilities which

are adaptable to changing longer-term conditions will allow the maintaining of suitable levels of station access as travel behavioural patterns evolve over time.

Further recommendations would apply to subsections of the corridor, including development of an integrated urban design and transport planning approach for Marshall, South Geelong and Waurn Ponds stations, which may conclude that their park and ride functionalities should be reduced rather than expanded. These types of efforts should be coordinated with all relevant stakeholders including V/Line, VicTrack and City of Greater Geelong.

Finally, it is recommended as a matter of principle that efforts to enhance or expand the nature of bus interchange functionalities be further explored at all stations. In particular the impacts of future bus service enhancements should be fully considered with upgraded interchanges oriented in a manner which promote the use of buses over arriving by car, in some cases benefitting from bus stopping locations that are relocated closer to station entrances.

7.3 Strategic development options

The strategic development options discussed in Chapter 6.0 are mostly linked to a number of policy and project initiatives that could occur in the next 10 to 25 years. As such, the advancements of specific improvements related to each station will be dependent on these other efforts, suggesting a set of next steps that entails coordination amongst projects and further investigation into the merits of each strategic initiative in a holistic sense.

Table 48 shows the linkages between each of the components of the short, medium and long term station development concepts and the wider planning considerations that may affect their necessity and timing.

Table 48 Summary of linkages and actions for short, medium and long term strategic development options

Program element	Dependencies	Action
Corridor wide strategies		
Medium term		
Commuter parking charges		Study of demand elasticity
Increased bus frequencies	Facility improvements	Catchment demand analysis
South Geelong to Waurn Ponds Rail Duplication – Infrastructure Upgrades Project (IUP)		Co-ordinate with key stakeholders on the medium term parking demands and proposals
Long term		
Electric vehicle charging infrastructure	Rate of EV uptake	Consideration of state, national and global trends in EV use
Autonomous vehicle facilities	Technological refinement	Coordination with state and national bodies on defining the deployment parameters of AVs
Lara station		
Short term		
Expansion of surface parking		Design analysis
Medium term		
Priority parking	EV, carpool and carshare uptake	Consultation with EV suppliers and carshare operators
Kiss and ride expansion		Design
Bus interchange expansion	Northern and Western Geelong Growth Areas transport solution	Coordination with PTV and City of Greater Geelong
Cycle parking expansion		Design and construction

Program element	Dependencies	Action
Cycle paths and road crossings		Design
Long term		
Parking structure development	Long term parking demand	Long term station design plan
Autonomous vehicle staging	Time frame of AV deployment	Coordination with state and national regulators
North Shore station		
Short Term		
Expansion of surface parking	Train stopping patterns and station usage	Design analysis
Medium Term		
Expansion of disabled parking		Design
Formal kiss and ride bays		Design
Formal taxi bays		Design
Priority parking	EV, carpool and carshare uptake	Consultation with EV suppliers and carshare operators
Long term		
Autonomous vehicle staging	Time frame of AV deployment	Coordination with state and national regulators
North Geelong station		
Short Term		
Expansion of surface parking		Design analysis
Medium Term		
Kiss and ride expansion		Design
Priority parking	EV, carpool and carshare uptake	Consultation with EV suppliers and carshare operators
Taxi zone expansion		Design
Parking structure	Station usage numbers, land use planning	Site investigation and traffic analysis
Expansion of disabled parking		Design
Long term		
Parking structure expansion or duplication	Station usage numbers	Coordination with long term strategic planning initiatives
Geelong station		
Medium Term		
Removal of commuter parking	Master planning staging	Design and wider station network upgrades
Conversion of existing carpark to priority parking on eastern side	Station design process	Coordination with long term station planning initiatives
Expansion of kiss and ride	Station design process	Coordination with long term station planning initiatives
Expansion of taxi zone	Station design process	Coordination with long term station planning initiatives

Program element	Dependencies	Action
Cycle parking expansion		Design
Open access drive from Swanston Street for public use		Design and upgrade
Long term		
Autonomous vehicle staging area	Station design process	Coordination with long term station planning initiatives
Further cycle parking expansion		Coordination with long term strategic active transport initiatives
South Geelong station		
Medium Term		
Parking structure	Longer term station usage patterns	Coordinate with PTV and City of Greater Geelong on corridor strategy advancement
Kiss and ride expansion		Design
Taxi zone rearrangement		Design
Pedestrian crossing treatment (Yarra Street)		Design
Cycle parking expansion		Design
Reorganisation of parking	Barwon Water development outcome	Coordination with long term station planning initiatives
Priority parking area	EV, carpool and carshare uptake	Consultation with EV suppliers and carshare operators
Long term		
Parking structure expansion	Station usage numbers	Coordination with long term strategic planning initiatives
Station plaza	Community input	Stakeholder and community engagement
Autonomous vehicle staging area	Time frame of AV deployment	Coordination with state and national regulators
Marshall station		
Short Term		
Surface carpark expansion	Land use planning	Design
Medium Term		
Parking structure	Land use planning	Coordinate with PTV and City of Greater Geelong on corridor strategy advancement
Connection to Drews Road	Traffic calming (north) and sealing (south) on Drews Road	Community engagement
Formal taxi and rideshare zone		Design
Cycle parking expansion		Design
Long term		
Parking structure	Longer term usage patterns; Torquay public transport corridor	Coordinate with PTV and City of Greater Geelong on corridor strategy advancement

Program element	Dependencies	Action
Autonomous vehicle staging area	Time frame of AV deployment	Coordination with state and national regulators
Waurin Ponds station		
Short Term		
Surface carpark expansion		Design
Medium Term		
Surface carpark expansion		Design
Kiss and ride expansion		Design
Formal taxi zone		Design
Priority parking	EV, carpool and carshare uptake	Consultation with EV suppliers and carshare operators
Long term		
Autonomous vehicle staging area	Time frame of AV deployment	Coordination with state and national regulators

8.0 Conclusion

This report has documented the findings of the Geelong Commuter Car Parking Strategy, intended to inform the development of parking and other access improvements to seven stations along the Geelong V/Line corridor.

This process has included an existing conditions analysis (including site observations and customer surveys), execution of a demand forecasting model for a variety of scenarios, and a context assessment of each station noting key opportunities to enhance walking, cycling and public transport options to increase the mode share of sustainable forms of travel.

In developing this commuter car parking strategy, the following tasks were undertaken:

- Background analysis of each of the seven stations, including assessment of current parking utilisation, travel behaviour (through customer surveys) and priorities for enhancement
- Comparative evaluation of the seven stations in terms of their facilities, usage and overall demand patterns
- Analysis of patronage growth potential by mode of access – including walking and cycling – through an assessment of contextual opportunities and constraints
- Demand forecasting analysis showing a variety of scenarios for future development outcomes in the corridor, including the consideration of high growth areas and infill development initiatives (particularly around Geelong station)
- Development of short (3-5 years) medium (10-15 years) and long term (20-25 years) options for addressing the growth in parking demand while also considering the impacts of technological changes (such as electric and autonomous vehicles) and other social, environmental and community objectives.

It is generally accepted by parking practitioners that 85 percent parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85 percent, it is generally more difficult for drivers to find available parking, resulting in undesirable practices such as excessive circulation or parking informally (at times in restricted areas).

There are a total of approximately 3,002 commuter parking spaces along the study corridor. On the survey day, 2,802 (93 percent) were observed to be utilised during the peak survey period. North Shore station was the only station with significant spare parking capacity (defined as less than 85 percent utilised) with only 23 (37 percent) of the available 63 parking spaces utilised on the survey day. This is partly due to the lower proportion of V/Line services that currently stop at this station.

As part of the questionnaire surveys the commuters were asked what suggested improvements they would prioritise for each station or its transport links. A total of 854 people were surveyed across all the stations, with 250 (29 percent) indicating a request for more car parking. These requests were most notable at North Geelong (45 percent), South Geelong (43 percent) and Marshall (34 percent), with requests lower at the other stations, Lara and Waurn Ponds (22 percent), Geelong (17 percent) and North Shore (3 percent).

Strategic modelling was undertaken to estimate the future patronage demands by access mode to each of the study railway stations under various years and scenarios. Overall, the constrained model scenarios were more realistic and robust than the unconstrained ones and the subsequent results were used to inform the medium (2031 with no Geelong station parking) and long (2041 with no Geelong station parking) scenarios.

The model forecast indicates that the total daily passenger entries to all study stations would increase from 8,700 in 2018 to 9,700 in 2021 to 16,000 in 2031, then to 20,100 (TfV land use scenario) or 21,400 (Council land use scenario) in 2041. Similarly, the parking demand is forecast to grow from 2,500 cars in 2018 to 2,700 in 2021 to 4,800 in 2031, then to 5,800 (TfV land use scenario) or 6,800 (Council land use scenario) in 2041.

When the parking at Geelong station is removed, the other access modes to the station (kiss and ride, cycling, public transport and walking) are predicted to increase by 24 percent, 60 percent, 33 percent

and 24 percent respectively. Overall the passenger entries to Geelong station would decrease slightly by 3 percent.

In this scenario it is predicted that the park and ride demand at adjacent stations North Geelong and South Geelong would increase by 85 percent and 18 percent respectively. Similarly, the park and ride demand at the further away stations of Corio, North Shore, Marshall and Waurn Ponds would increase by 14 to 16 percent, and that at Lara station would increase by 3 percent.

The tables below show the parking shortfalls in the medium (2031) and long (2041) term timeframes by station and by total across the study corridor when parking is removed from Geelong station.

Table 49 Summary of station parking demand (cars) under all scenarios

Station	Lara		Corio		North Shore		North Geelong	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2031								
Constrained - NGP	993	-354	19	62	71	-6	853	-299
2041								
Cons.- GLU & NGP	1,848	-1,209	23	58	83	-18	1,459	-905
Station	Geelong		South Geelong		Marshall		Waurn Ponds	
	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall	Projected parking demands	Parking shortfall
2031								
Constrained - NGP	-	-	771	-218	1,326	-879	734	-361
2041								
Cons.- GLU & NGP	-	-	963	-410	1,539	-1,092	853	-480

Key: GLU – Geelong Land Use NGP – No Geelong Parking

Table 50 Total study area car parking provisions

Scenario	Predicated parking requirements	Total shortfall in commuter car parking
2018 Surveyed parking supply	3,176	-
2018 Surveyed parking demand	2,934	242
2031 Constrained model - NGP	4,767	-1,591
2041 Constrained - GLU & NGP	6,768	-3,592

Key: GLU – Geelong Land Use NGP – No Geelong Parking

The outcomes of the aforementioned tasks have aided in the development of the following short, medium and long term development programs:

- Short term development programs (next 3 to 5 years) that entail expansion of surface parking in the near term to cater to current demand trends, however arranged in a manner that would enable incremental conversion to other uses as travel behaviour evolves toward alternate modes or emerging technologies. Stations identified for parking expansion include:
 - Lara station with an additional 450 at-grade parking spaces
 - North Shore station with an additional 206 at-grade parking spaces, subject to an increase in V/Line trains stopping at this station
 - North Geelong station with an additional 350 at-grade parking spaces, however this is on DTF land which would be subject to review (if not available a parking structure may be needed to facilitate short term parking demands)

- Marshall station with an additional 802 at-grade parking spaces on vacant land to the south of the existing southernmost car park
- Waurm Ponds station with an additional 302 at-grade parking spaces (mixture of formalising and new spaces) on land to the east of the existing car park
- Medium term development programs (within 10 to 15 years) for each of the stations that strengthen the transition from car use to alternate modes, with a continued focus on structuring any new car parking facilities (surface or deck) in a manner that is consistent with surrounding planning contexts and convertible to other uses. These need to be co-ordinated at South Geelong, Marshall and Waurm Ponds with the Geelong to Waurm Ponds Infrastructure Upgrade Project (IUP) proposed project work.
- Long term development programs (within 20 to 25 years) for each of the stations that recognise the impact of land use changes, strategic planning objectives, autonomous vehicles, and increased use of rideshare and connecting bus services.

The precise time frames of each of these development targets is dependent on a number of factors for which their implementation remains unknown, including local policy and strategic context (for example Marshall Precinct Structure Plan) and the rate and form of population growth, the development of new connecting bus services, and the widespread deployment of autonomous vehicles. As such the development programs should be viewed as flexible design frameworks that can be adapted to the progression of any key inputs.

Overall there is potential to accommodate patronage growth within the Geelong V/Line service corridor over the time frames outlined, though a shift toward more sustainable forms of access will be required to optimise the efficiency of passenger delivery to each of the stations.

Appendix A

Existing Conditions

Appendix A – Existing Conditions

This appendix outlines the existing conditions at each of the study stations with regards to station accessibility, station facilities, undeveloped land and planned local development. This assessment has been completed via a combination of site visits, surveys, desktop assessments and stakeholder consultation.

1.1 Existing station accessibility and facilities

1.1.1 Lara Station

The existing conditions at Lara Station are provided in **Table 1** and referred to figures.

Table 1 Existing conditions - Lara Station

Item		Description
Station Accessibility	Services	Lara Station has an island platform with Platform 1 providing V/Line services to Southern Cross and Platform 2 providing V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurn Ponds. The station is staffed part-time.
	Platform Access	Single access point onto the platforms and station with an at-grade pedestrian crossing.
	Vehicle Access	Access to the station carpark is provided via various cross-overs on Hicks Street, see Figure 1.
	Walking	Hicks Street provides footpaths on its eastern side only. Footpaths are provided intermittently between parking aisles in the station carpark onwards to the main station entrance. Footpaths are provided along the north of the carpark from McClelland Avenue to the station entrance. See Figure 2.
	Cycling	McClelland Avenue, Mill Road and Rennie Street (bicycle lanes provided) are part of the existing principal bicycle network. A proposed off-road bicycle path is proposed from Little River to the existing Bacchus Marsh Road on road bicycle paths. See Figure 3.
	Bus	Serviced by bus routes 10, 11 and 12 as shown from Figure 4.
Station Facilities	Car parking	589 off-street car parking spaces (includes 14 disabled spaces). An informal (gravel) parking area was sealed and now caters for approximately 50 cars. See Figure 1.
	Bus facilities	One bus stop for three bus services.
	Kiss and Ride	Three five-minute bays located immediately east of the pedestrian level crossing, see Figure 1 for location.
	Bicycle facilities	Nine bicycle loops (capacity for 18 bicycles). Also, six bicycle lockers. See Figure 3 for locations.
	Taxi facilities	None
	Wheelchair accessible	Yes. Ramp to access platforms.
	Tactile paths	No
Hearing loop	No	
On-street carparking		Hicks Street has 29 parking spaces, with 21 spaces under 1/4P restriction 8am till 8pm (Mon-Sun) and eight spaces with no restrictions, see Figure 1. It was observed that overflow parking also parked informally on the western verge along Hicks Street.

Figure 1 Lara Station – Vehicle Access and Car Parking

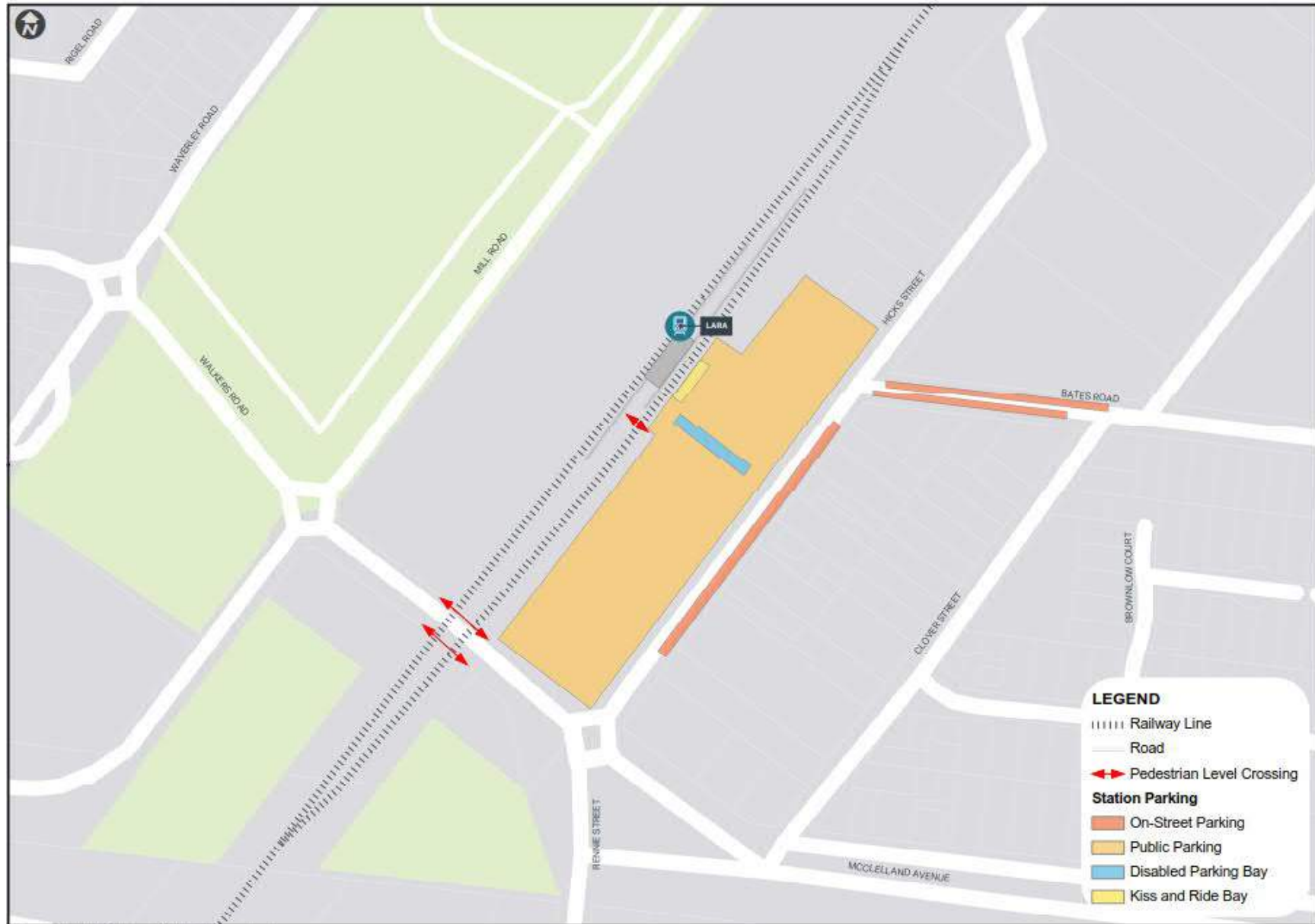


Figure 2 Lara Station – Pedestrian Provision

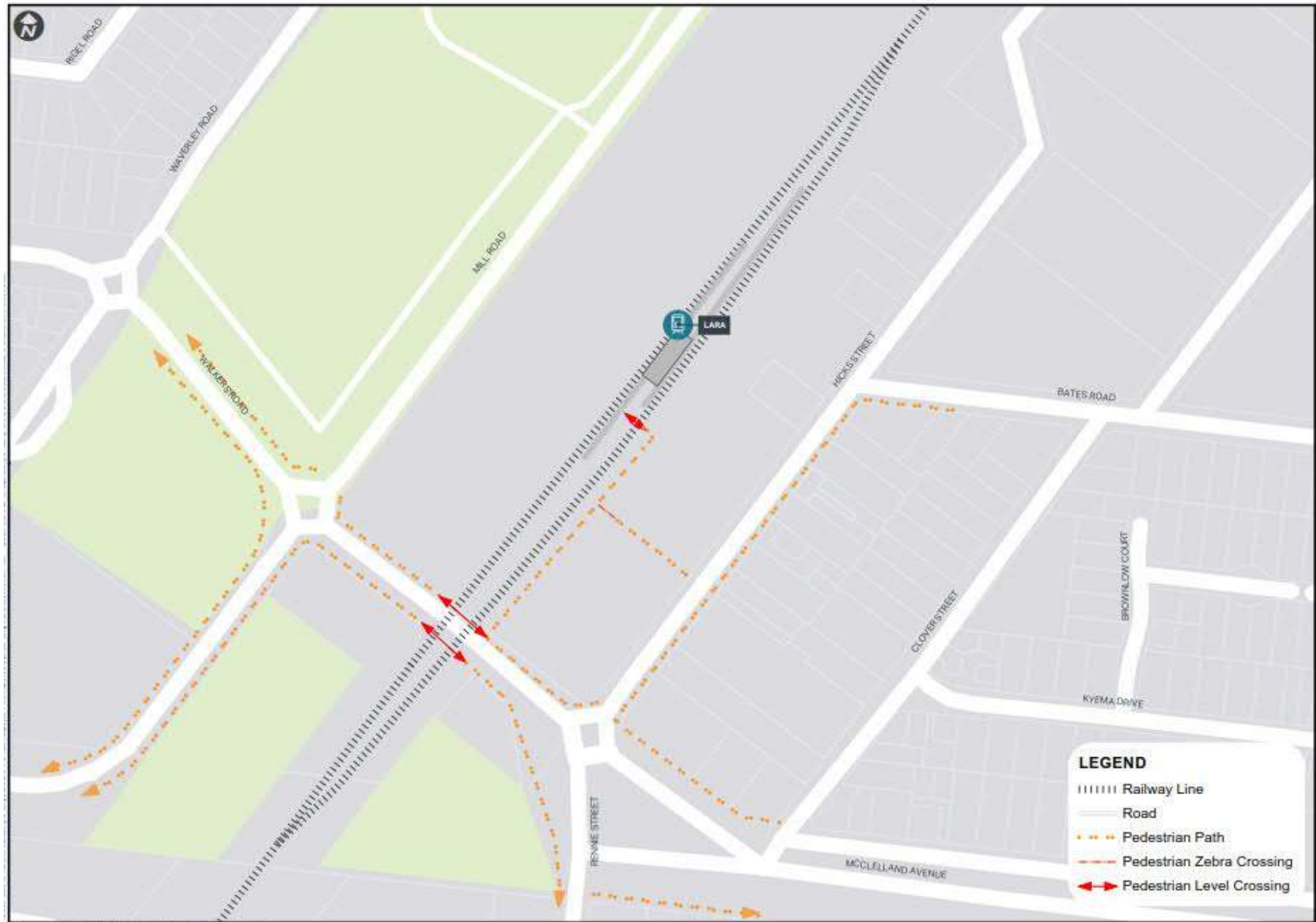
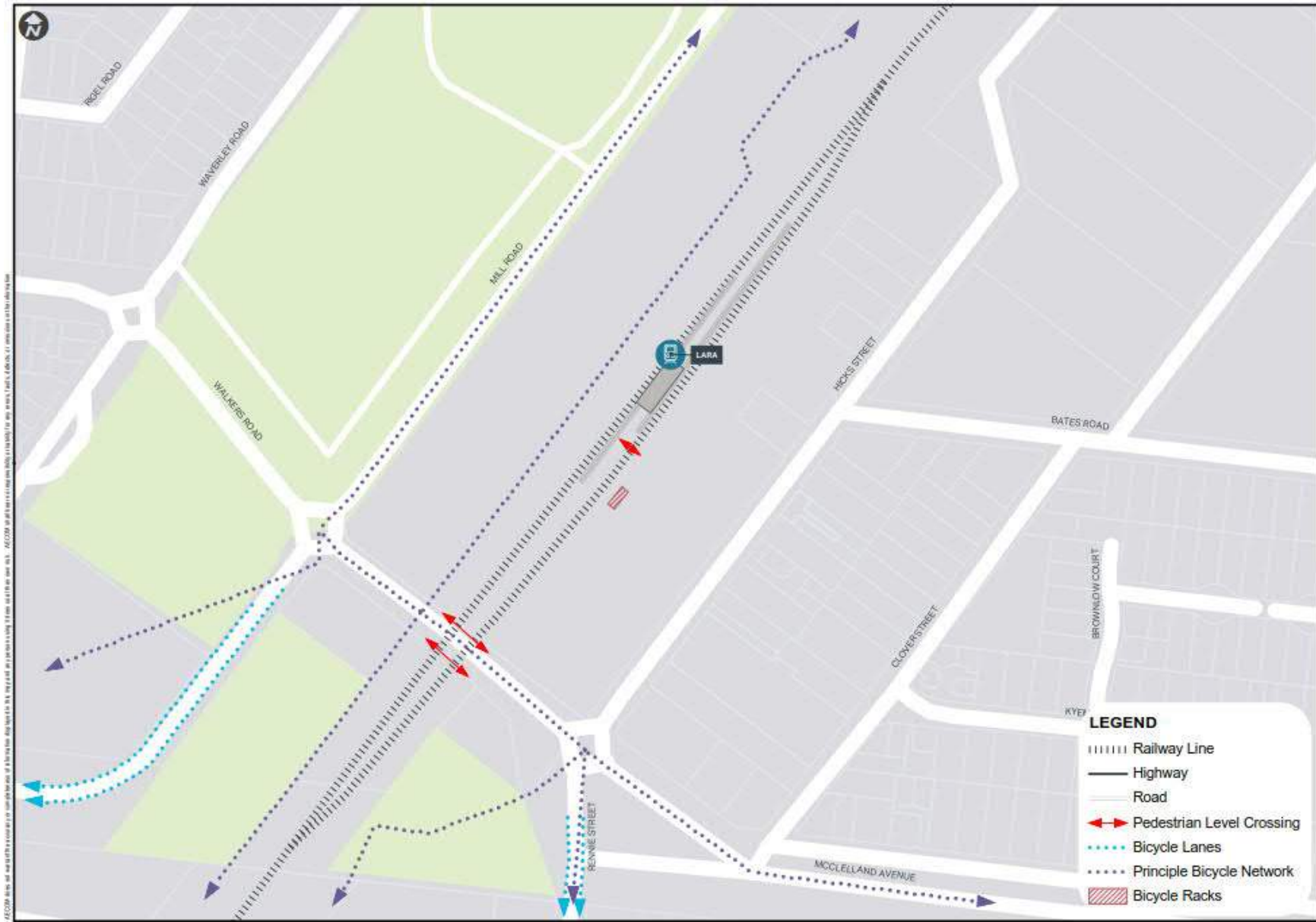
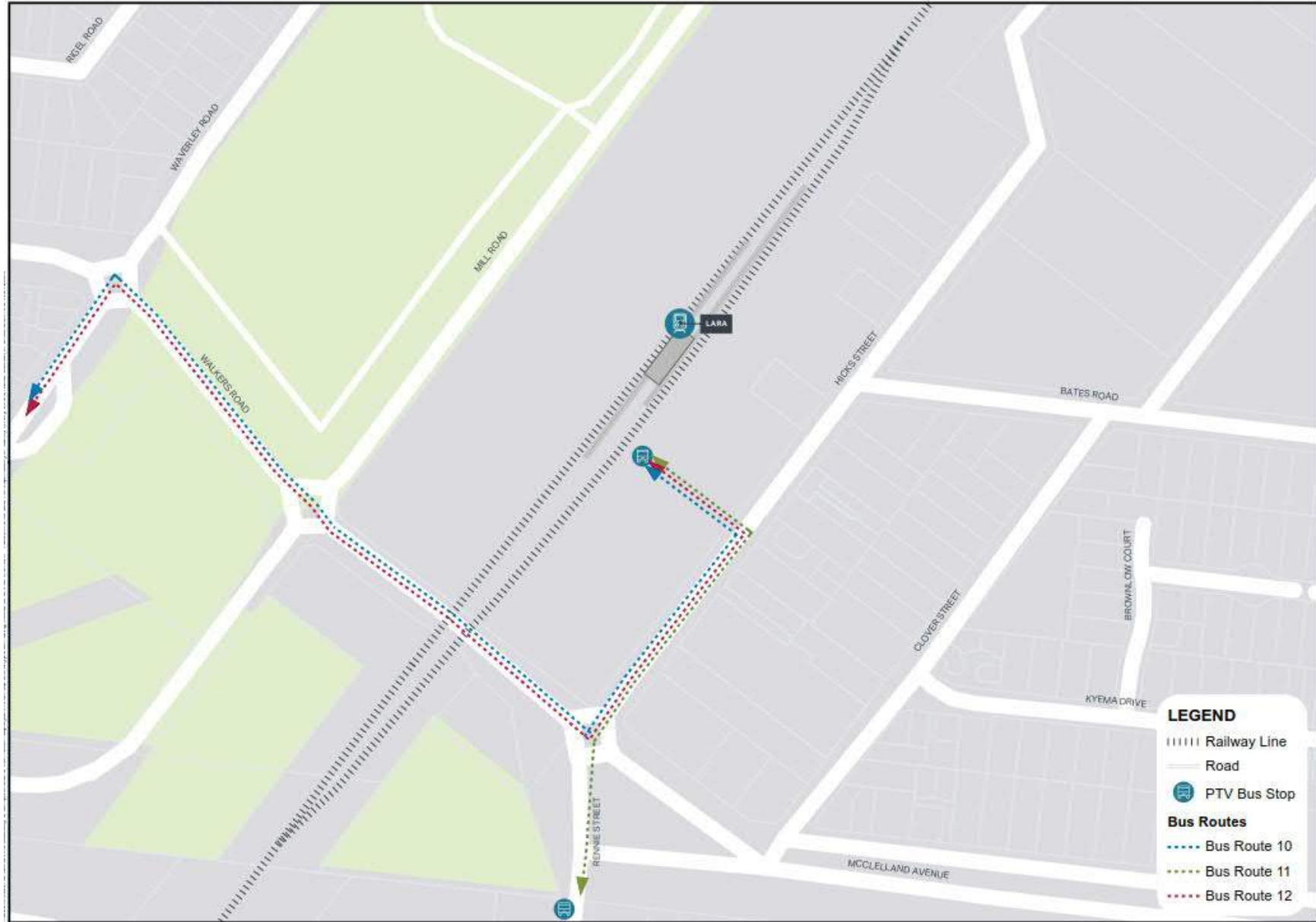


Figure 3 Lara Station – Bicycle Provision



AECOM and its consultants do not warrant the accuracy or completeness of the information and data provided in this map. AECOM and its consultants shall not be liable for any errors or omissions in this map.

Figure 4 Lara Station – Bus Routes and Stops



1.1.2 North Shore Station

The existing conditions at North Shore Station are provided in Table 2 and referred to figures.

Table 2 Existing conditions – North Shore Station

Item		Description
Station Accessibility	Services	North Shore Station consists of three platforms, platform 1 and 2 are situated as an island platform and Platform 3 is a side platform. Platform 1 provides V/Line services to Southern Cross. Platform 2 provides V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurm Ponds. Platform 3 is The Overland train which operates between Southern Cross and Adelaide Parklands. The station has no station building and is un-staffed.
	Platform Access	Single access point onto Platform 3 and single access point onto island platforms 1 and 2 via at-grade pedestrian crossing.
	Vehicle Access	Access to the station carpark is provided via a single cross-over from Station Street, see Figure 5.
	Walking	Footpaths provided on all local roads. Pedestrians must cross the railway line at-grade to access platforms 1 and 2. See Figure 6.
	Cycling	Bicycle lanes provided on Station Street and Aberly Road, which are also part of the principal bicycle network. See Figure 7.
	Bus	Serviced by bus routes 1, 22 and 23, see Figure 8.
Station Facilities	Car parking	65 off-street carparking spaces (includes two disabled spaces). No motorcycle bays.
	Bus facilities	No internal bus facilities, bus stops located on Station Street in direct vicinity to station as shown on Figure 8.
	Kiss and Ride	None
	Bicycle facilities	Five bicycle loops (capacity for 10 bicycles). Spirals with capacity for eight bicycles.
	Taxi facilities	None
	Wheelchair accessible	Yes. Ramp to access platforms
	Tactile paths	Two disabled parking spaces
Hearing loop	No	
On-street carparking		No associated on-street parking, since off-street car park has sufficient capacity.

Figure 5 North Shore Station – Vehicle Access and Car Parking

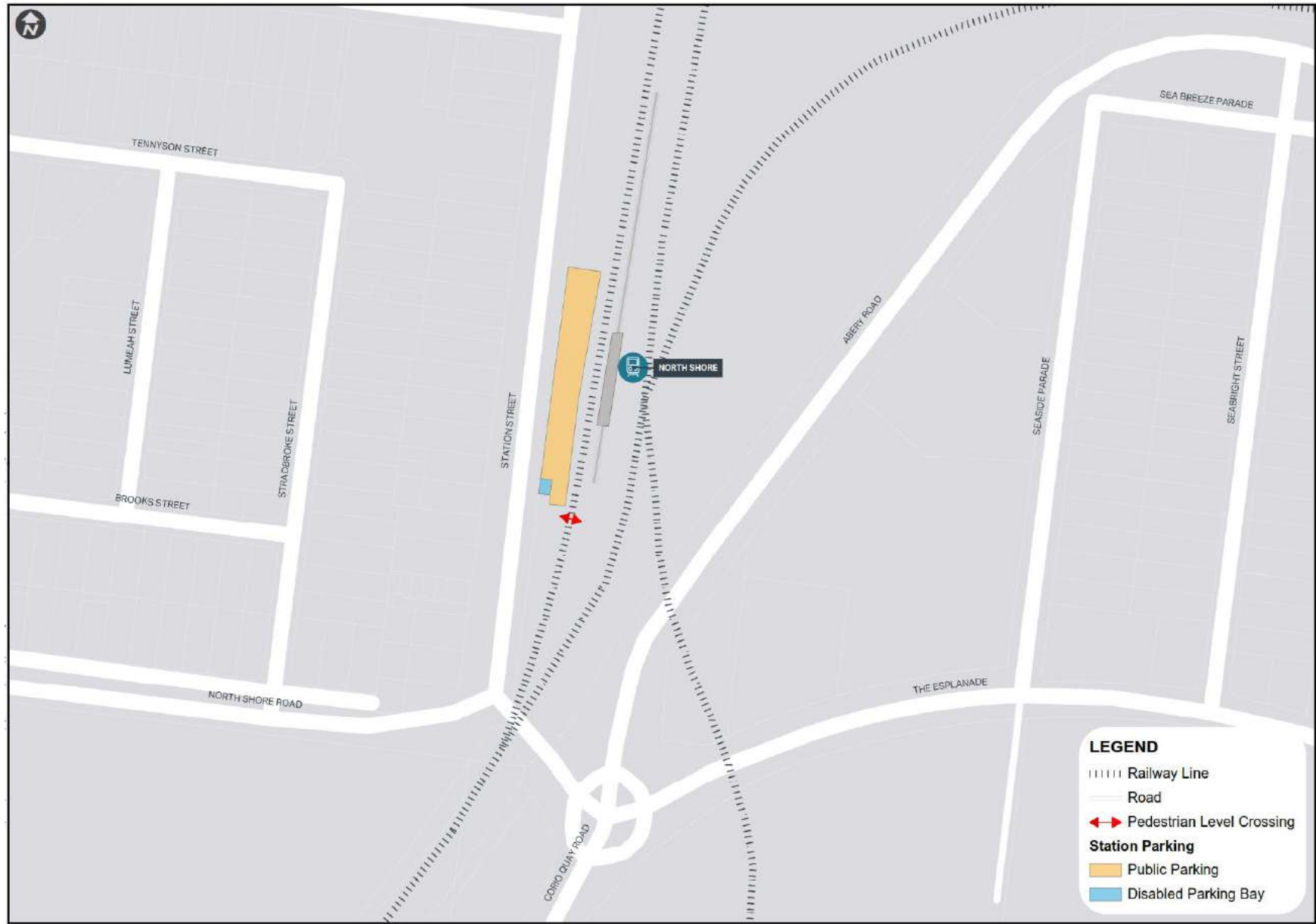


Figure 6 North Shore Station – Pedestrian Provision

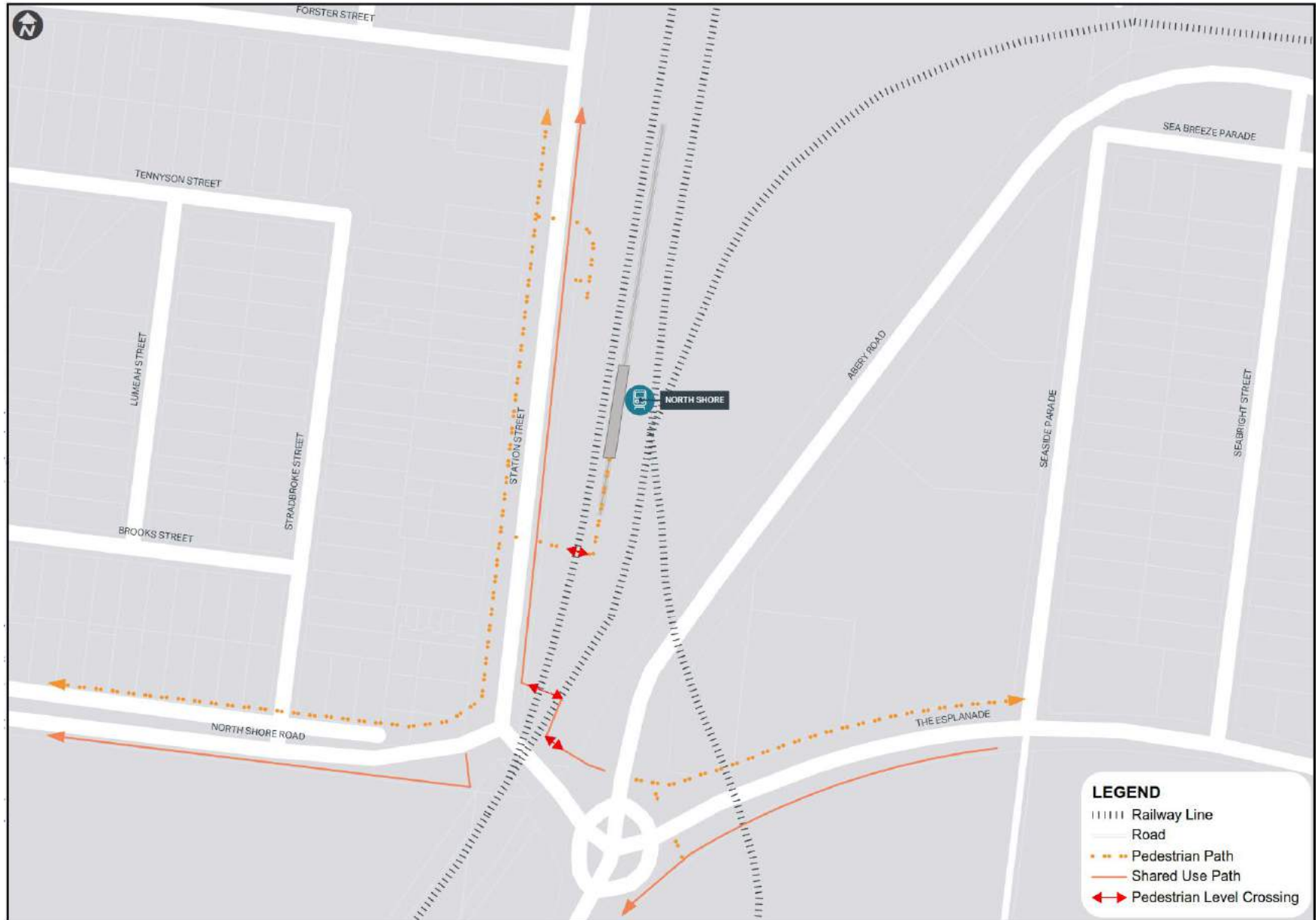


Figure 7 North Shore Station – Bicycle Provision

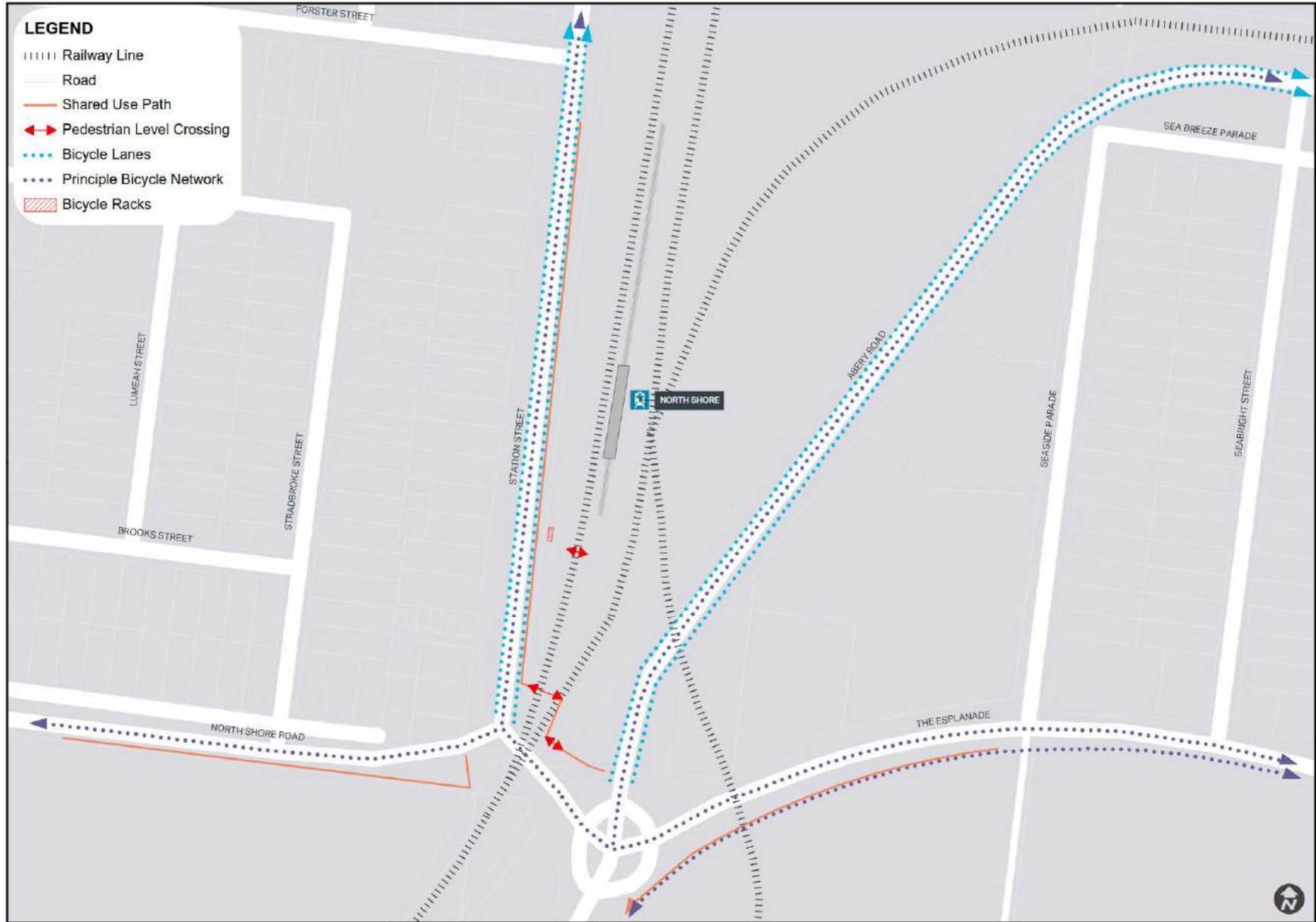
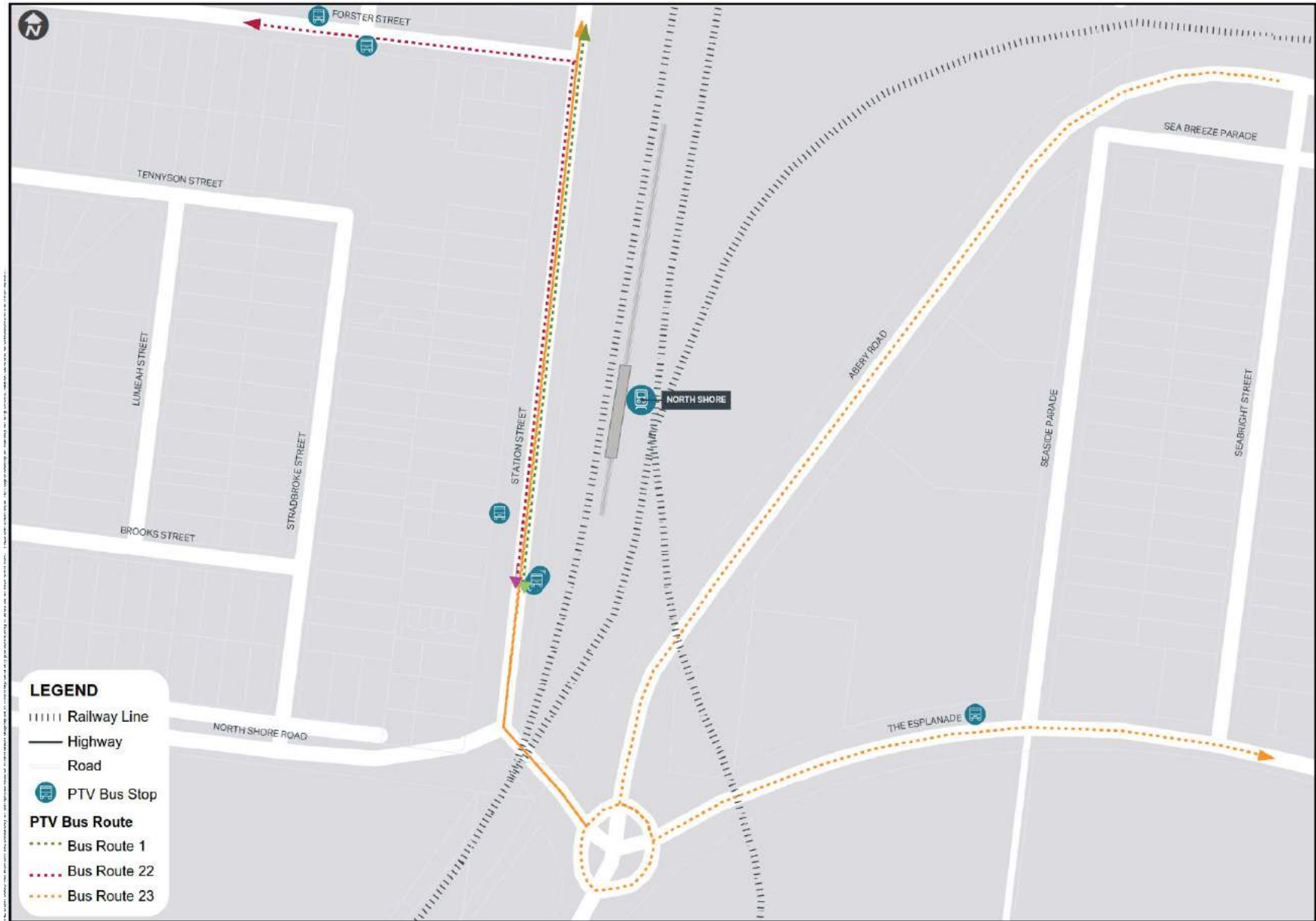


Figure 8 North Shore Station – Bus Routes and Stops



1.1.3 North Geelong Station

The existing conditions at North Geelong Station are provided in Table 3 and referred to figures.

Table 3 Existing conditions – North Geelong Station

Item		Description
Station Accessibility	Services	North Geelong Station consists of two side platforms on either side of the rail line connected via a grade-separated pedestrian crossing. Platform 1 provides V/Line services to Southern Cross and Platform 2 provides V/Line services to Warrnambool, Geelong, South Geelong, Marshall and Waurin Ponds. The station has a station building on the western side which is staffed part-time.
	Platform Access	Two access points for the eastern platform and three for the western platform.
	Vehicle Access	The station has vehicle access either side of the railway line. On the eastern side the station is accessed via a one-way service road connecting off the Princes Highway. On the western side the station carparks are accessed via Victoria Street. See Figure 9.
	Walking	All local streets have footpaths provided. Key pedestrian links to the station are provided via the Princes Highway / Victoria Street signalised intersection which has pedestrian crossings incorporated on all approaches and a zebra crossing on the service road to the east of the railway line. A pedestrian underpass is present to the south of the station for platform access on either side of the rail way line. See Figure 10.
	Cycling	Victoria Street to the west of the railway line has on-road bicycle lanes. Shared path on the east of the railway line along the Princes Highway service road. See Figure 11.
	Bus	Serviced by bus routes 20 and 24.as shown on Figure 12.
Station Facilities	Car parking	454 off-street carparking spaces (includes 10 disabled spaces). An informal (gravel) parking area is available which caters for approximately 100 cars. See Figure 9.
	Bus facilities	No internal bus facilities, a bus stop (no.20) is located on the eastern side of the station via one-way service road off Princes Highway, and on western side (no.24) on Victoria Street, to west of Baxter Road. See Figure 12.
	Kiss and Ride	Three five-minute bays on the eastern side. Seven kiss and ride spaces on the western side next to the station building (15minsP)
	Bicycle facilities	Bicycle loops with capacity for 26 bicycles, along with bicycle lockers catering for eight bicycles.
	Taxi facilities	Taxi zone on the eastern side to the north of bus stop. Two taxi spaces present, location shown on Figure 9.
	Wheelchair accessible	Yes. Ramp to access platforms. Toilets are accessible.
	Tactile paths	No
	Hearing loop	No
On-street carparking	No associated on-street parking, for the purposes of this study assumed that parking on service road is off-street parking as associated with station usage.	

Figure 9 North Geelong Station – Vehicle Access and Car Parking

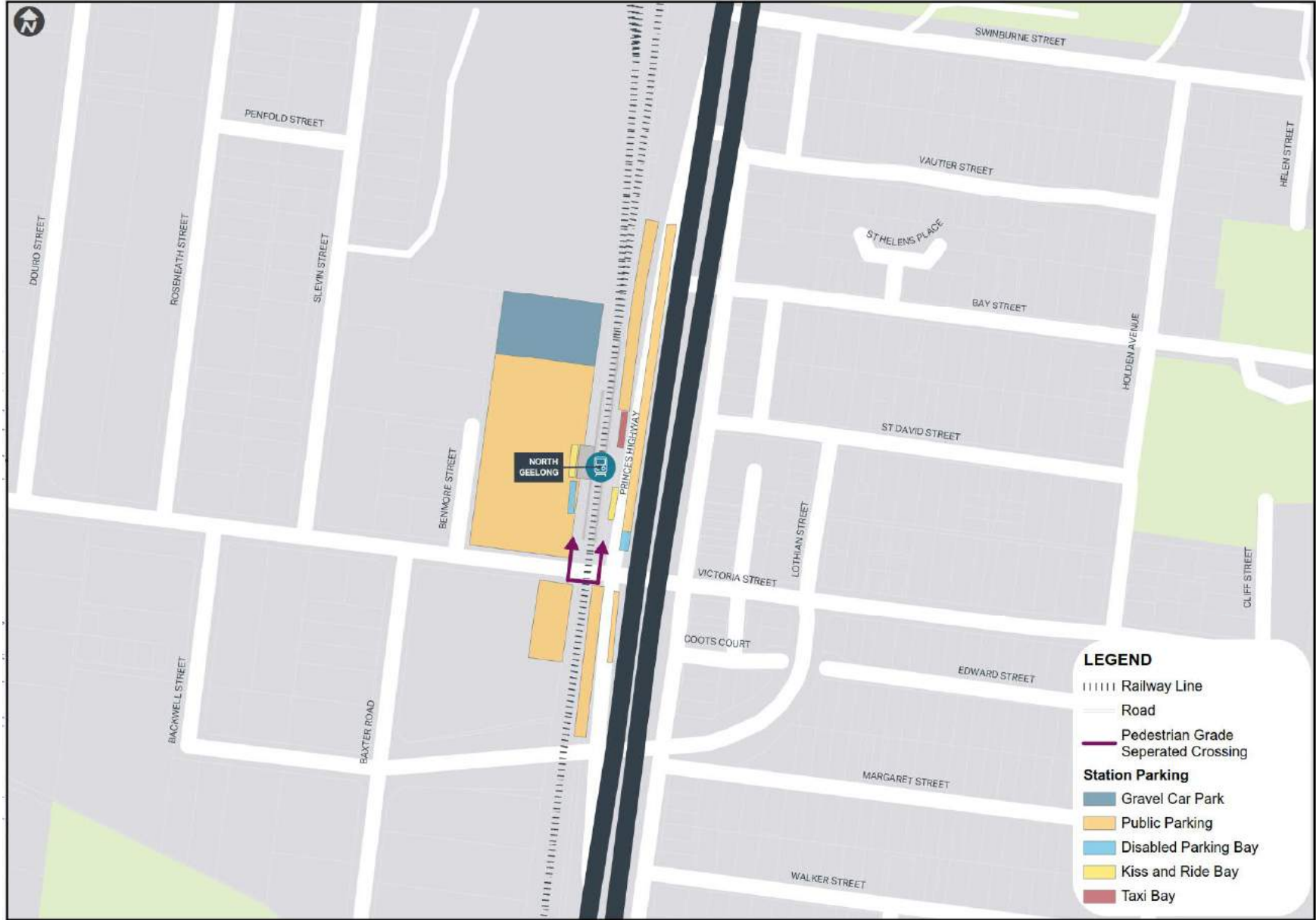


Figure 10 North Geelong Station – Pedestrian Provision

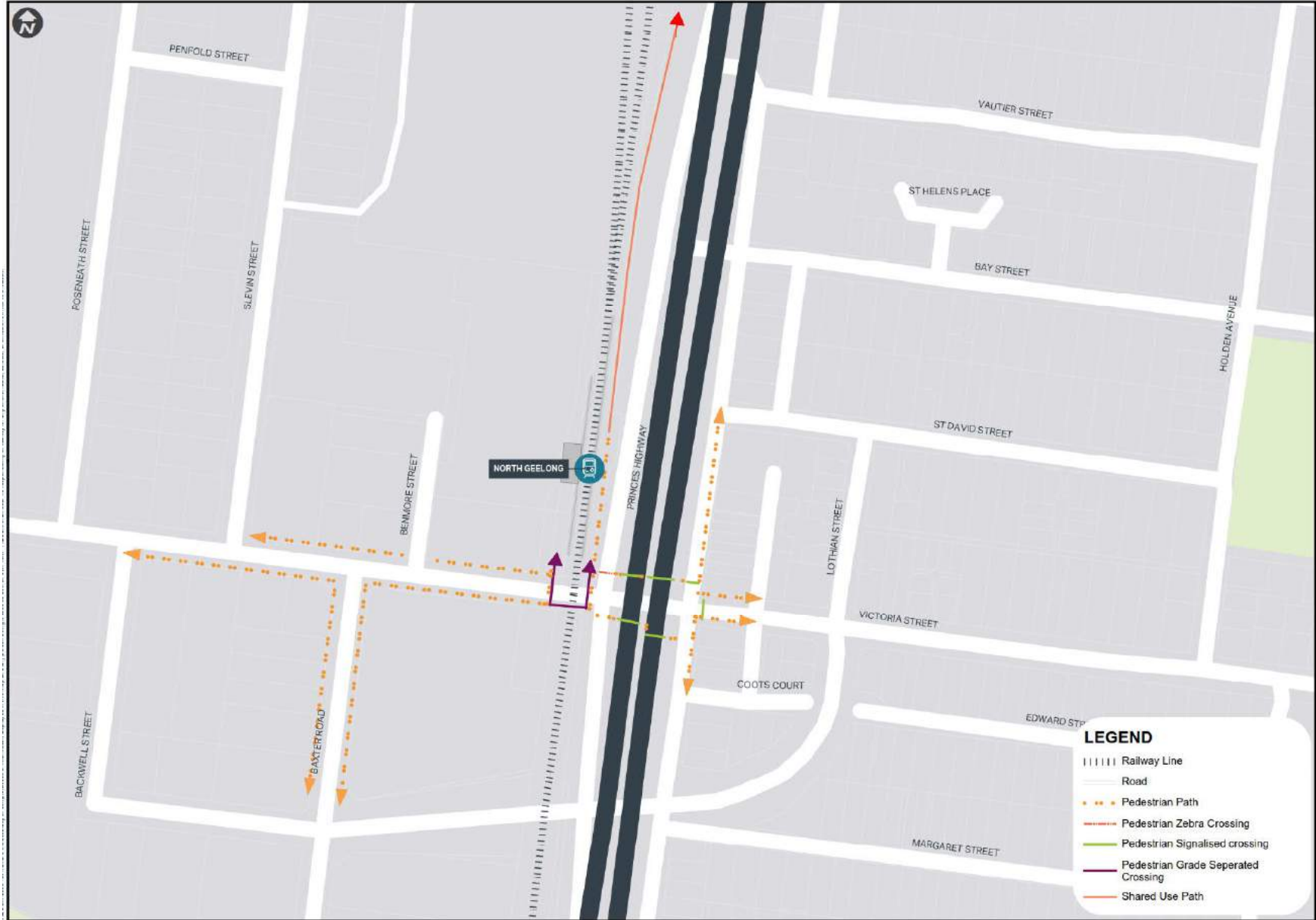


Figure 11 North Geelong Station – Bicycle Provision

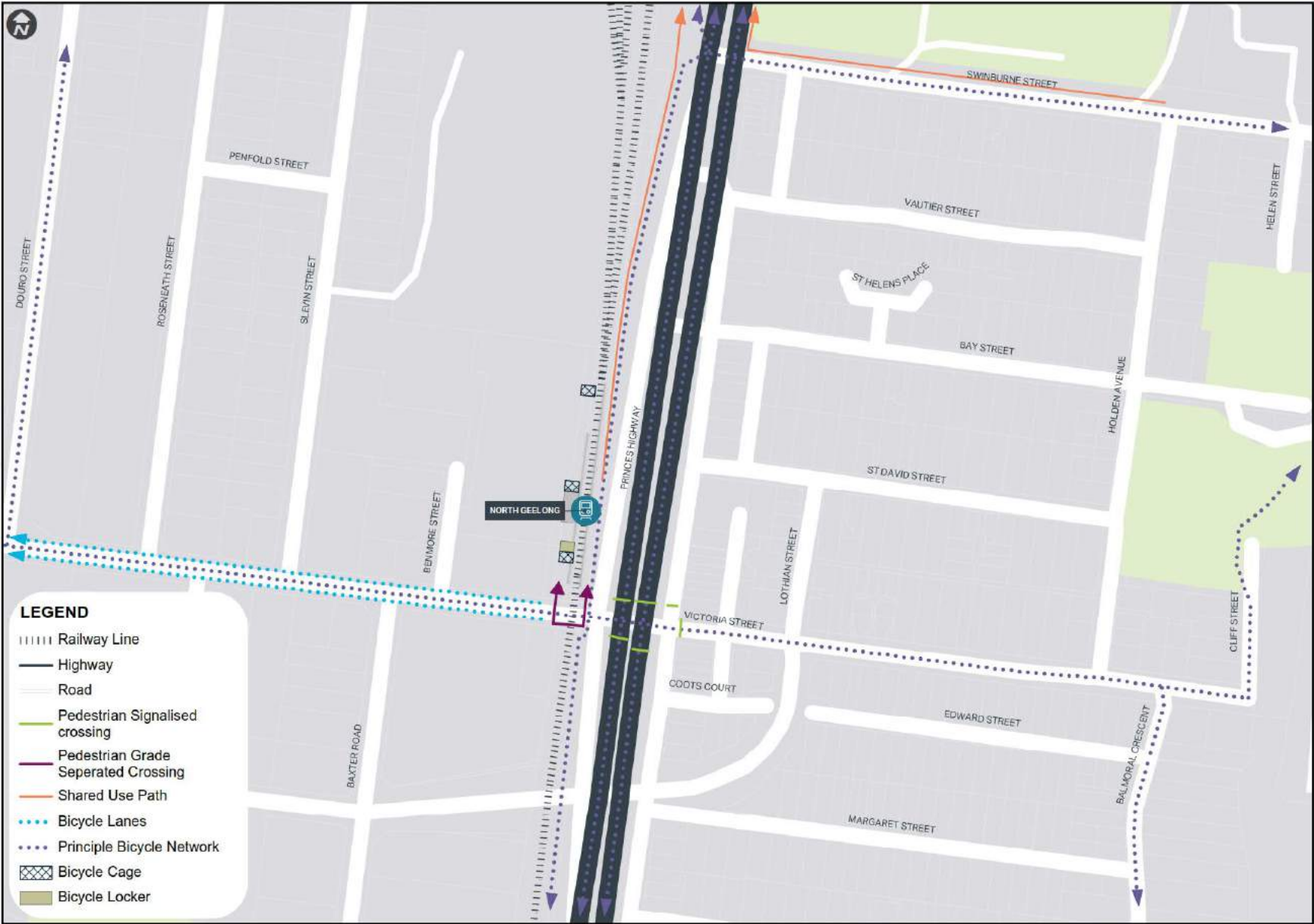
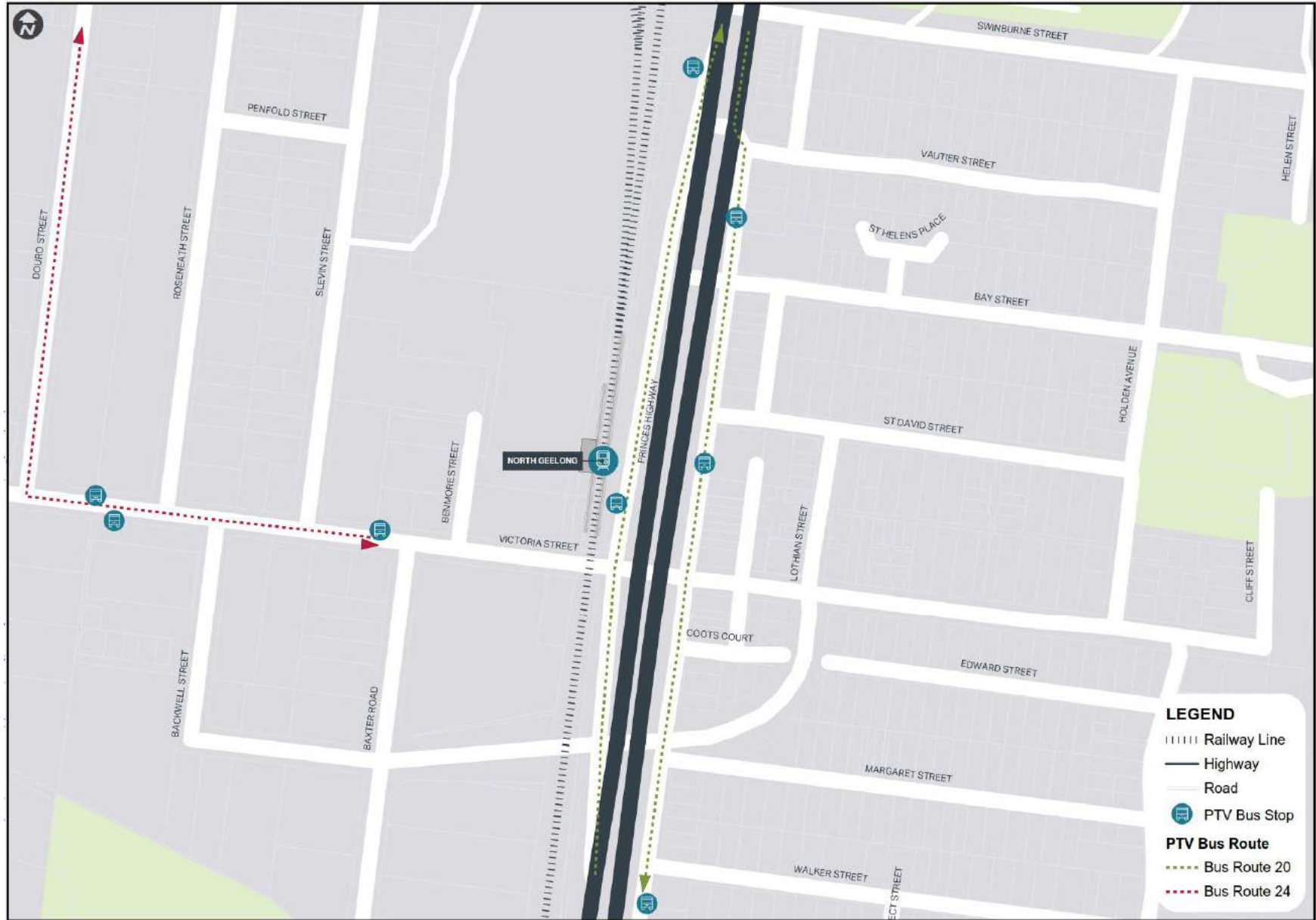


Figure 12 North Geelong Station – Bus Routes and Stops



1.1.4 Geelong Station

The existing conditions at Geelong Station are provided in **Table 4** and referred to figures.

Table 4 Existing conditions - Geelong Station

Item		Description
Station Accessibility	Services	Geelong Station consists of three platforms, platform 1 is a side platform and platforms 2 and 3 are an island platform. Platform 1 provides V/Line services to South Geelong, Marshall, Waurn Ponds and Warrnambool. Platform 2 provides V/Line services towards Southern Cross when Platform 3 is occupied. Platform 3 provides V/Line services towards Southern Cross The station has a station building and is staffed.
	Platform Access	Six access points to access the platforms (three through the station building, one via the bus loop area, one via the eastern carpark and one via the staircase from Brougham Street)
	Vehicle Access	The station has vehicle access either side of the railway line. On the eastern side the station is accessed via Trainshed Way which forms a signalised intersection with Mercer Street and Bayley Street. On the western side the station carparks are accessed via a cross-over which forms part of the Latrobe Terrace and Gordon Avenue signalised intersection. See Figure 13.
	Walking	All local streets have footpaths provided. Pedestrian crossings are incorporated on all approaches at the Mercer Street / Bayley Street and Latrobe Terrace / Gordon Avenue signalised intersections. See Figure 14.
	Cycling	Bicycle lanes provided on Mercer Street, see Figure 15.
	Bus	Serviced by bus routes 22, 24, 25, 30, 31, 32, 40, 41, 42, 43, 50, 51, 55, 56, 60 and 61, see Figure 16.
Station Facilities	Car parking	Eastern station car park has a total of 97 parking spaces, with only 21 spaces being unrestricted. V/Line customer only (41), kiss and ride (12) and motorcycle only (9) spaces. The adjacent 102 permit-only spaces are associated with the Law Court and are not available to commuters. Western station car park has 443 car parking spaces with no restrictions. See Figure 13.
	Bus facilities	Bus interchange (with 11 bus bays) is located to the southeast of the station and is accessed via Railway Terrace.
	Kiss and Ride	12 kiss and ride bays on eastern side of station, see Figure 13.
	Bicycle facilities	Bicycle loops with capacity for 18 bicycles. Bicycle spirals catering for 14 bicycles and bicycle lockers for four bicycles. A Parkiteer Cage is also present with a capacity of 26 bicycles (12 loops and 14 hanging).
	Taxi facilities	Yes, six taxi bays provided
	Wheelchair accessible	Yes. Elevator and ramps to access platforms 2 and 3.
	Tactile paths	Yes
Hearing loop	Yes	
On-street carparking		No associated on-street parking. On-street carparking in the immediate area is paid and highly unlikely to be used by commuters.

Figure 13 Geelong Station – Vehicle Access and Car Parking

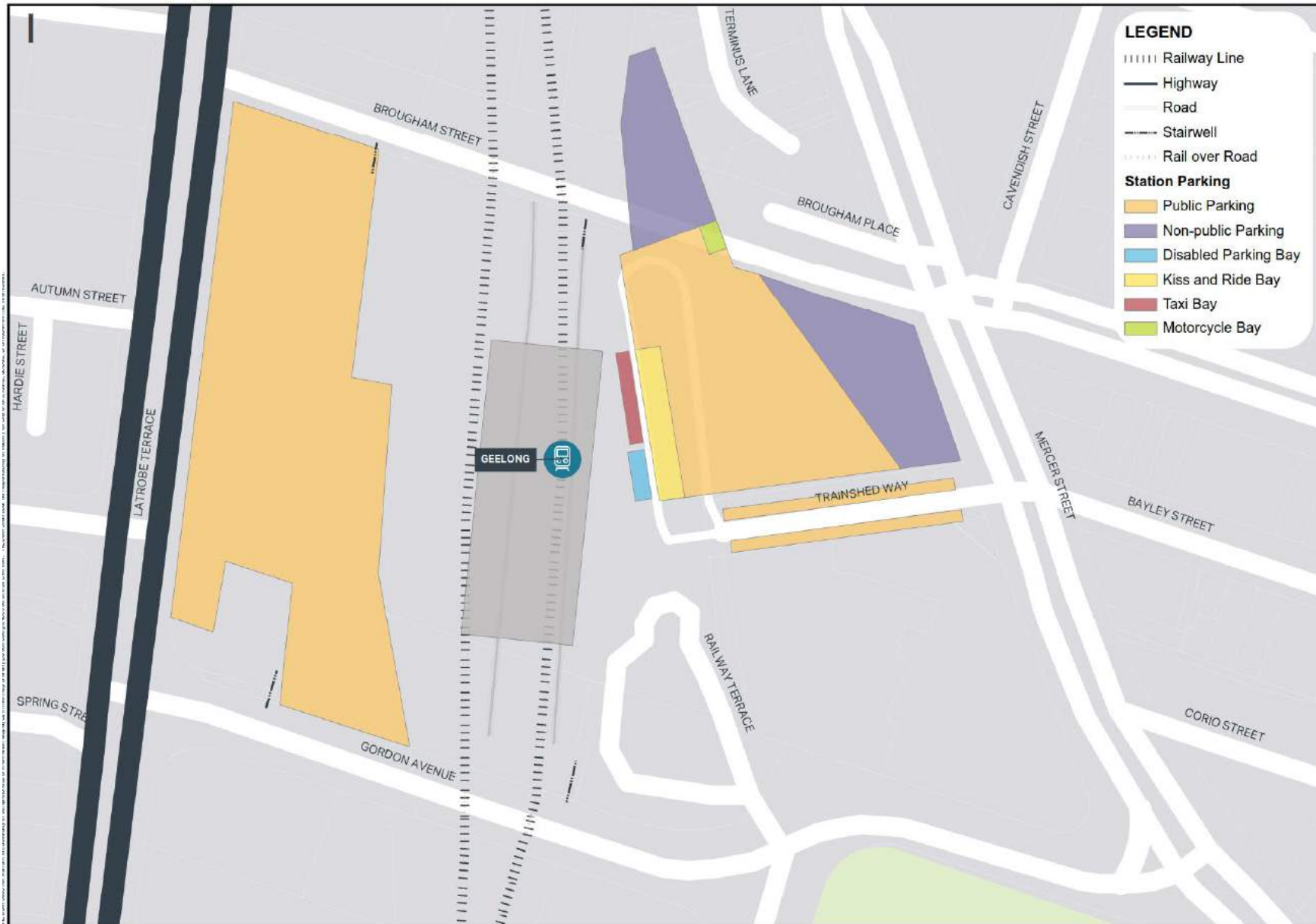


Figure 14 Geelong Station – Pedestrian Provision

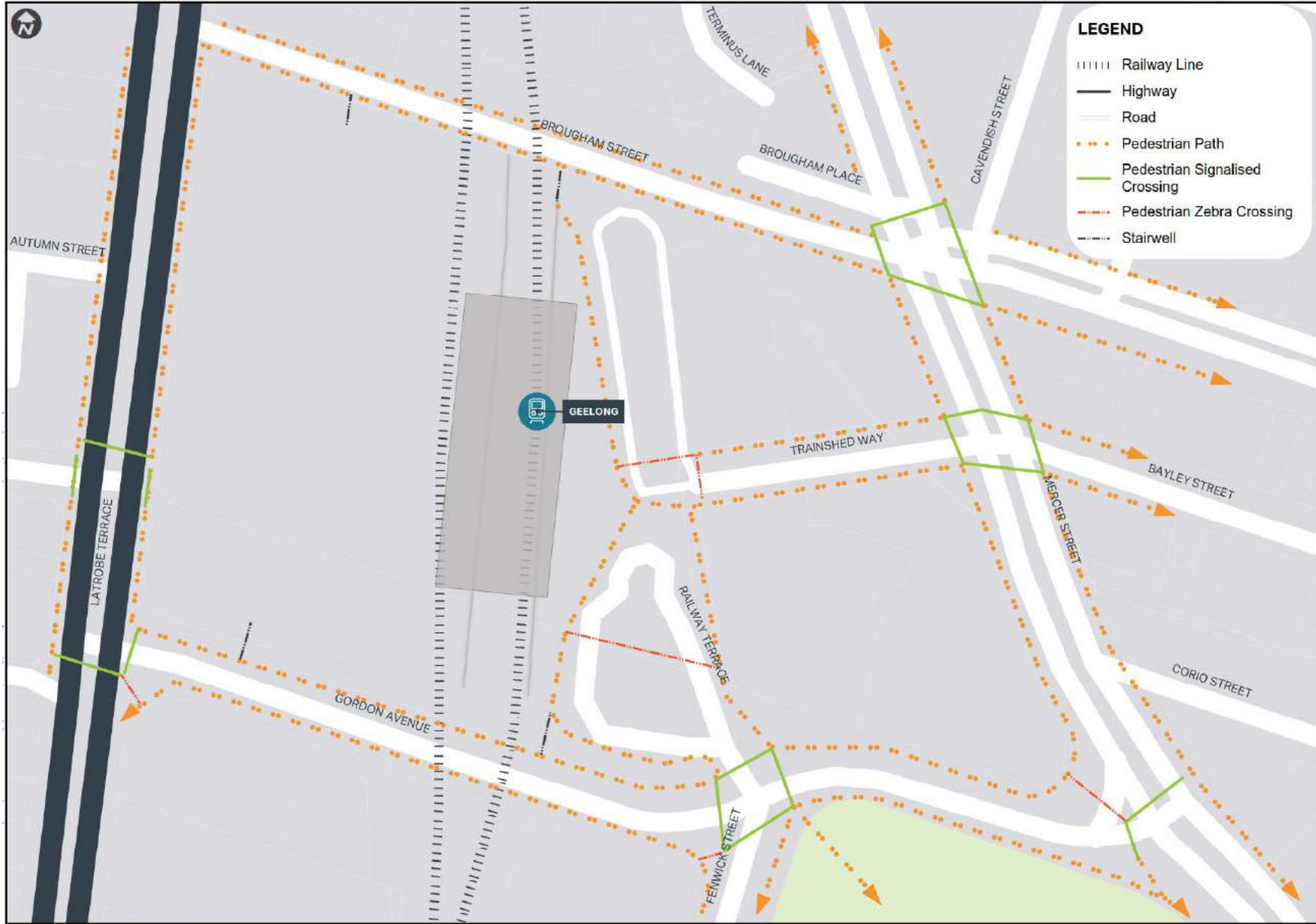


Figure 15 Geelong Station – Bicycle Provision

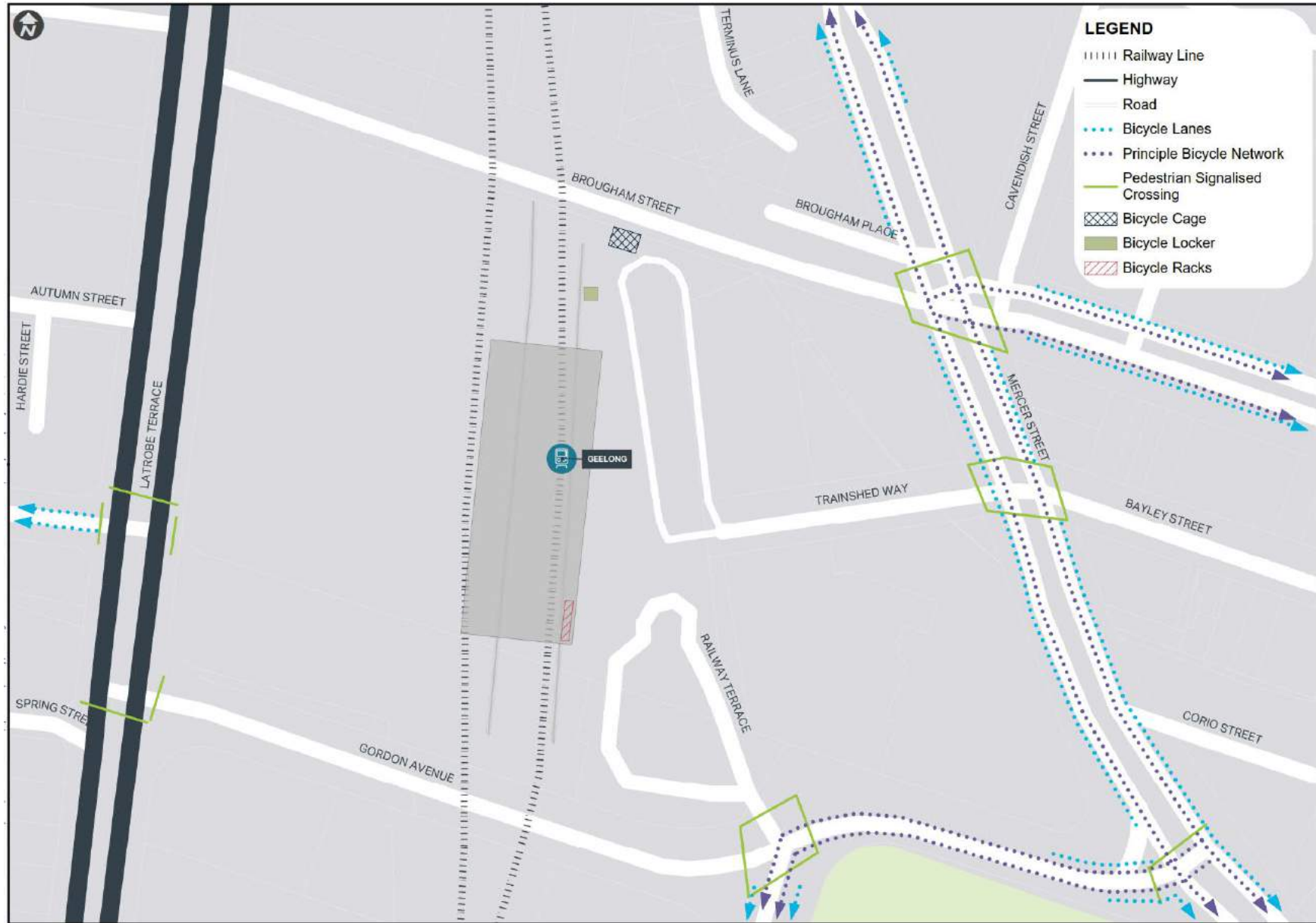
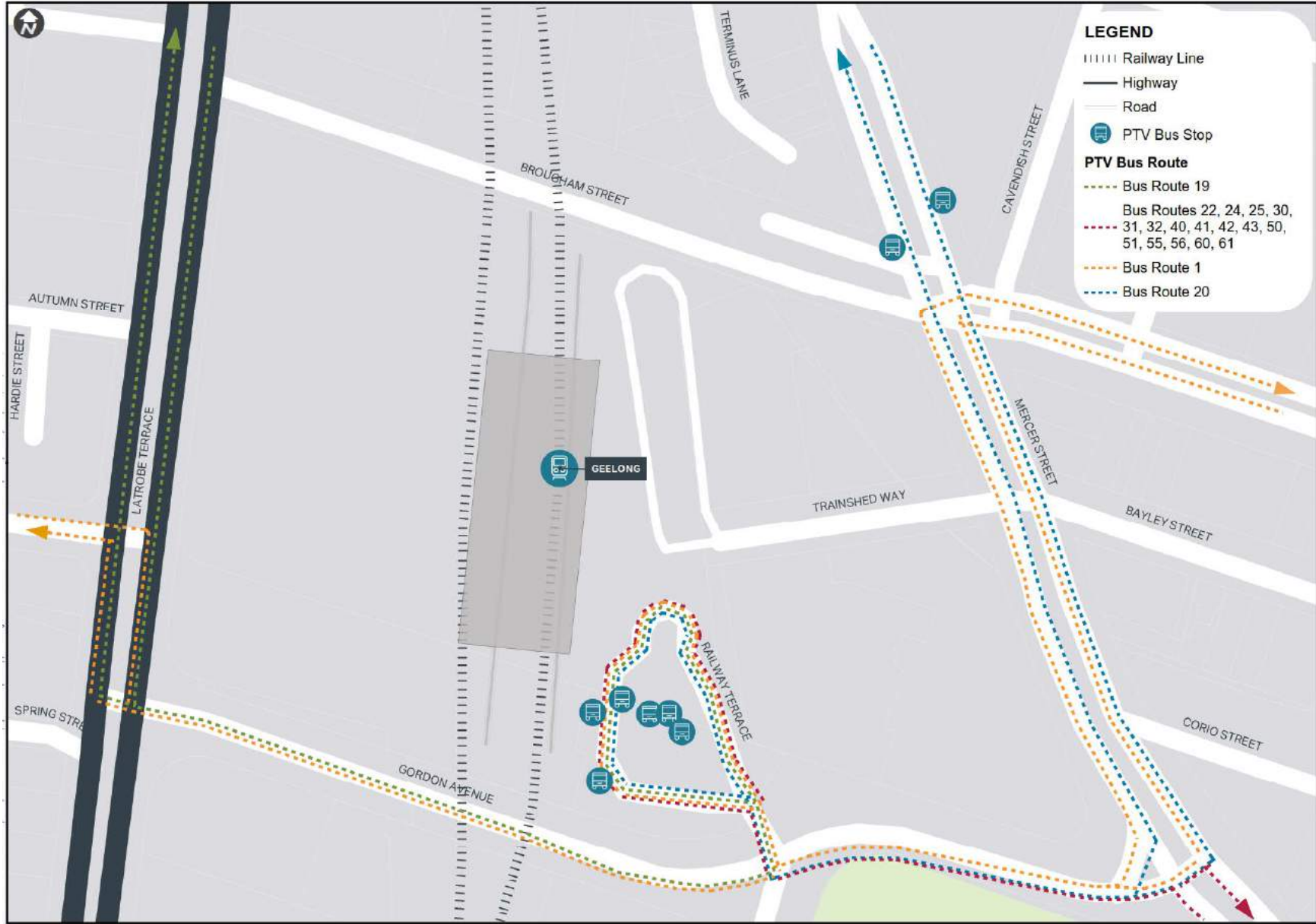


Figure 16 Geelong Station – Bus Routes and Stops



1.1.5 South Geelong Station

The existing conditions at South Geelong Station are provided in Table 5 and referred to figures.

Table 5 Existing conditions – South Geelong Station

Item		Description
Station Accessibility	Services	South Geelong Station consists of a single platform which provides V/Line services to Marshall, Waurin Ponds, Southern Cross and Warrnambool. The station has a station building and is staffed part time.
	Platform Access	Five access points onto the platform (one through the station building, three via the carpark and one via Yarra Street)
	Vehicle Access	The station carpark can be accessed via crossovers provided on Yarra Street (entry only implied although no formal signage) and Verner Street (two all movement accesses and a single exit). See Figure 17.
	Walking	All local streets have footpaths provided as shown on Figure 18.
	Cycling	Shared use path along Carr Street and Lonsdale Street. Bicycle lanes along Yarra Street and Swanston Street. See Figure 19.
	Bus	Serviced by bus routes 1 and 101, see Figure 20.
Station Facilities	Car parking	553 off-street carparking spaces (includes eight disabled bays) Also, five authorised V/line parking only spaces. The sealing of 200 gravel car parking spaces will be complete by mid December 2018. See Figure 17.
	Bus facilities	Three VLine bus replacement bus stops located internally, however no public bus stops. Bus stop located on Yarra Street in direct vicinity to station. Skybus stop present on Yarra Street. See Figure 20.
	Kiss and Ride	Five 10-minute bays in immediate proximity of the station building as shown on Figure 17.
	Bicycle facilities	Bicycle loops with capacity for 36 bicycles. A Parkiteer Cage is present which caters for a total of 26 bicycles (12 loops and 14 hanging)
	Taxi facilities	Five taxi bays provided.
	Wheelchair accessible	Yes. Ramp to access platform and toilets.
	Tactile paths	Yes
	Hearing loop	No
On-street carparking		Foster Street provides 254 parking spaces with a mixture of unrestricted and 4P restrictions. Bellerine Street provides 107 parking spaces with a mixture of unrestricted, 2P and 4P restrictions. Yarra Street provides 67 parking spaces with a mixture of unrestricted, 2P and 4P restrictions. Verner Street provides 104 parking spaces with a mixture of unrestricted, 1/4P, 1P, 2P and 4P restrictions. Lonsdale Street provides 138 parking spaces with a mixture of 1/2P, 1P, 2P and 4P restrictions. Carr Street provides 190 parking spaces which are unrestricted. Mundy Street provides 123 parking spaces which are unrestricted.

Figure 17 South Geelong Station – Vehicle Access and Car Parking

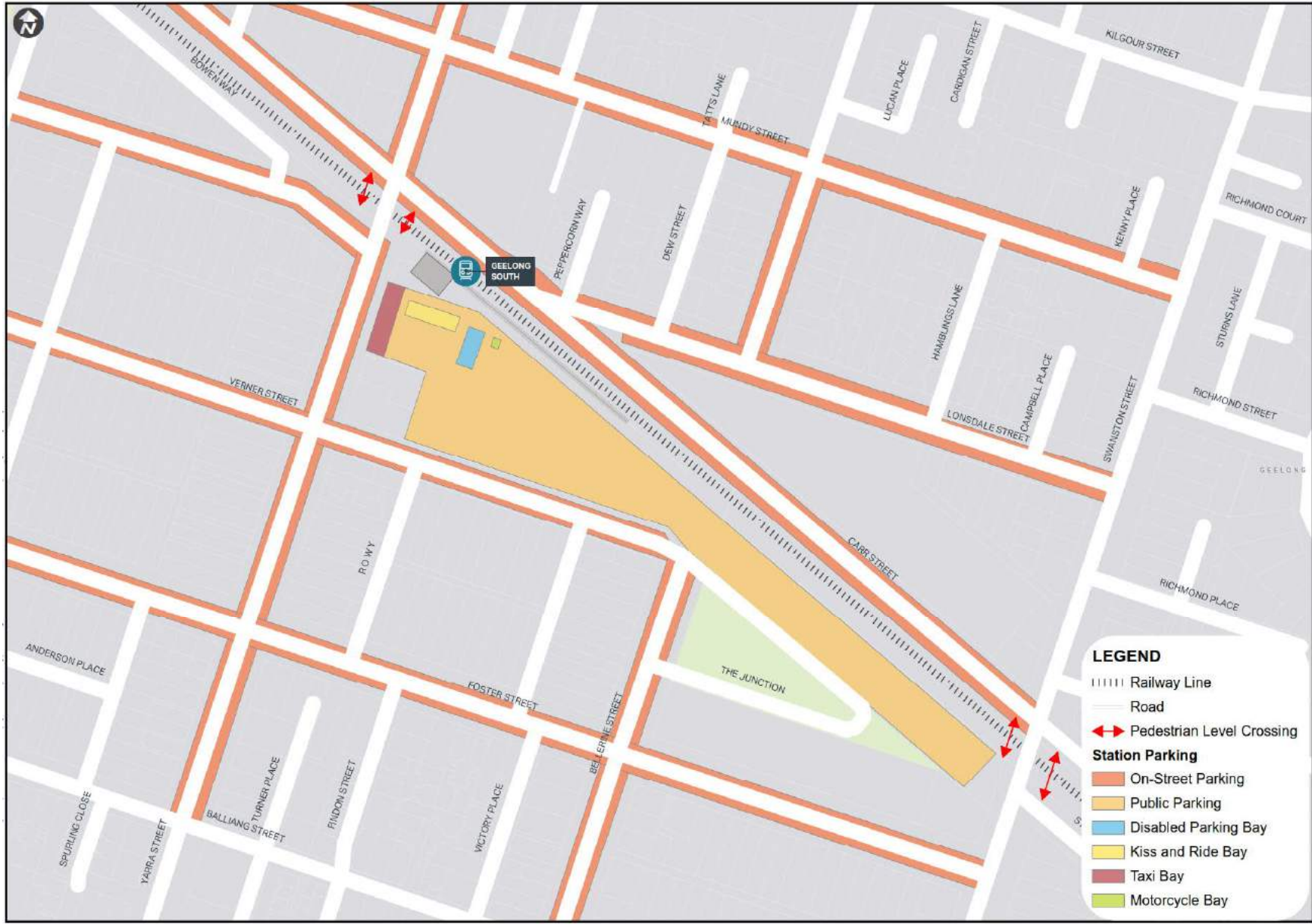


Figure 18 South Geelong Station – Pedestrian Provision

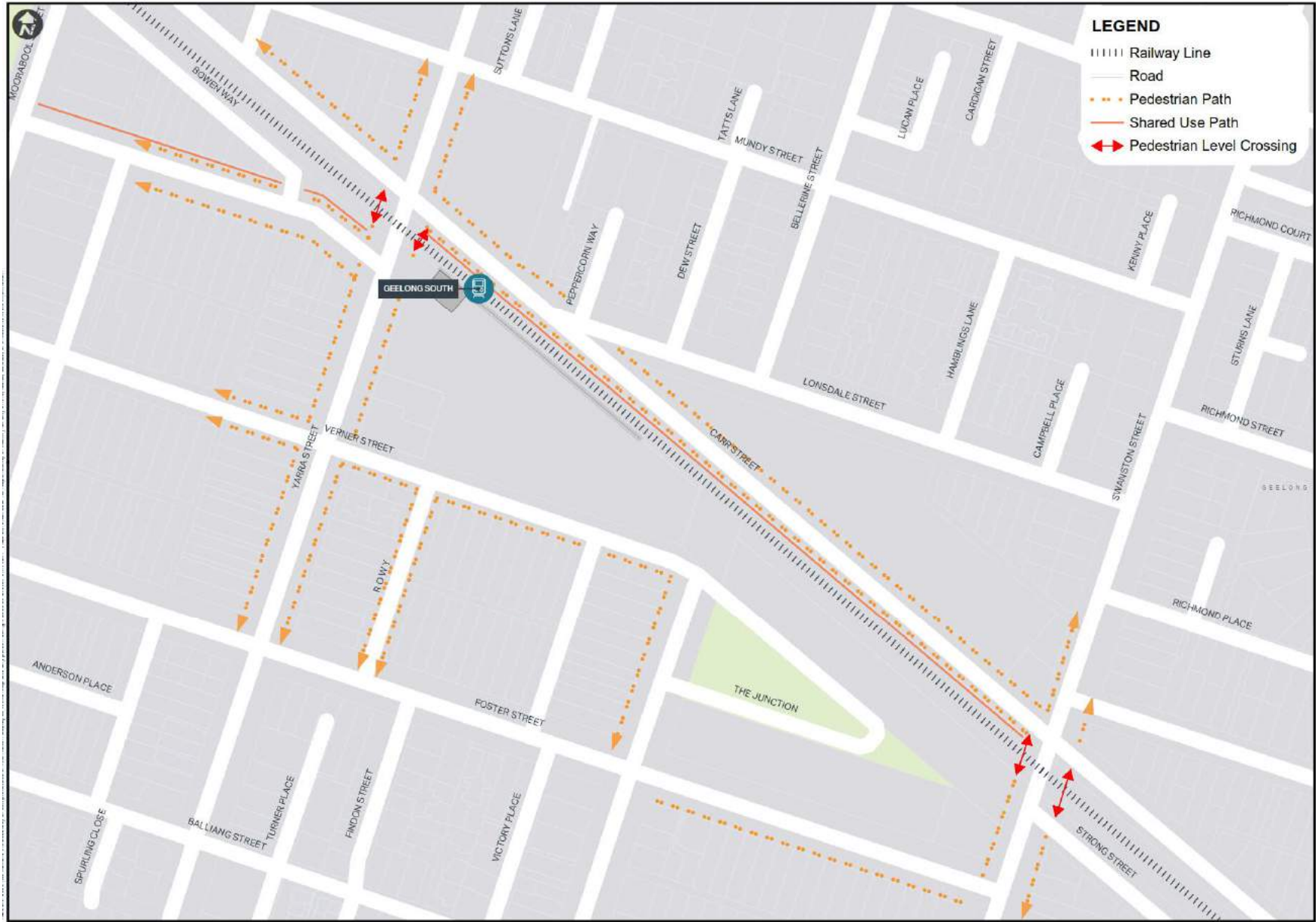


Figure 19 South Geelong Station – Bicycle Provision

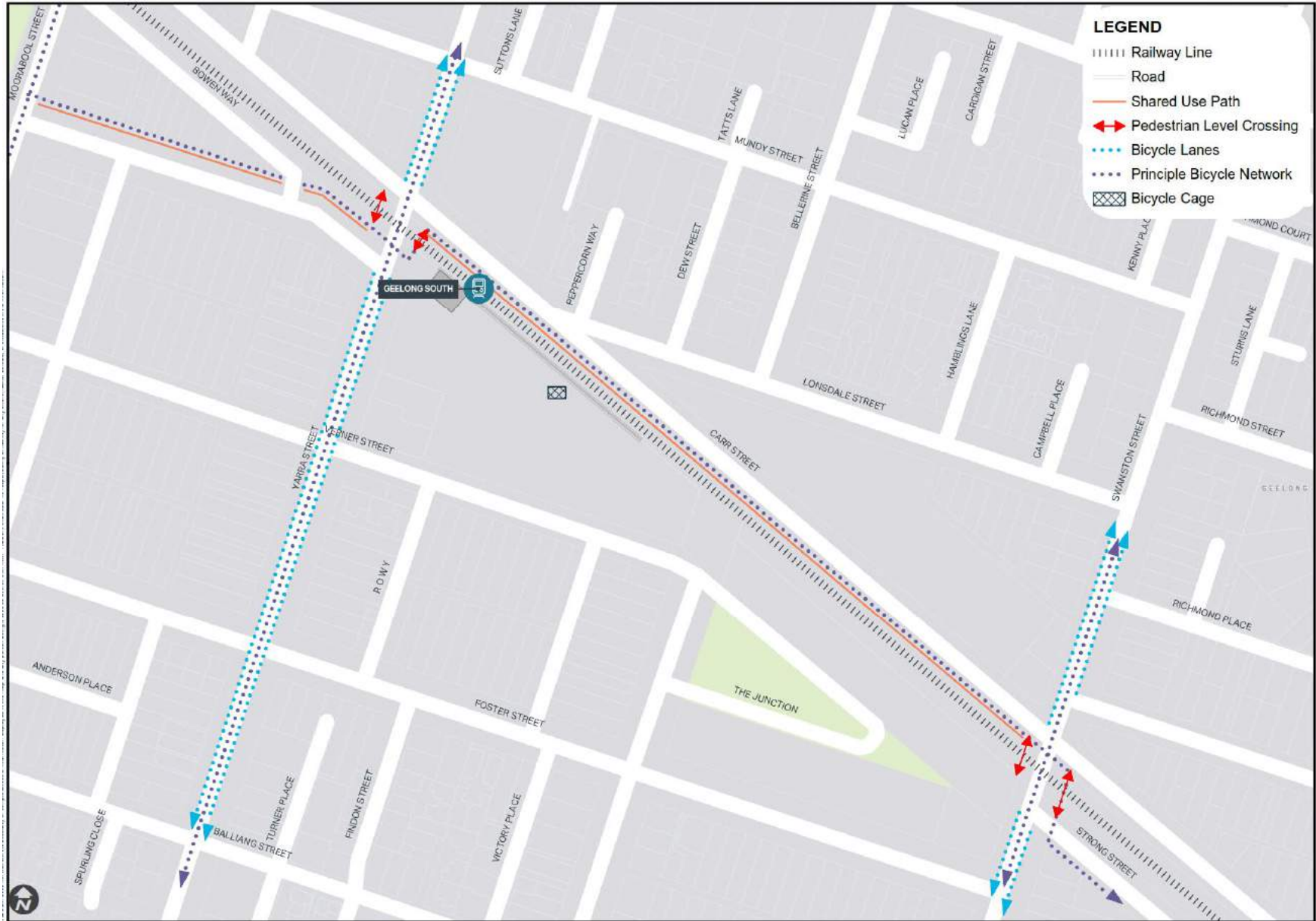
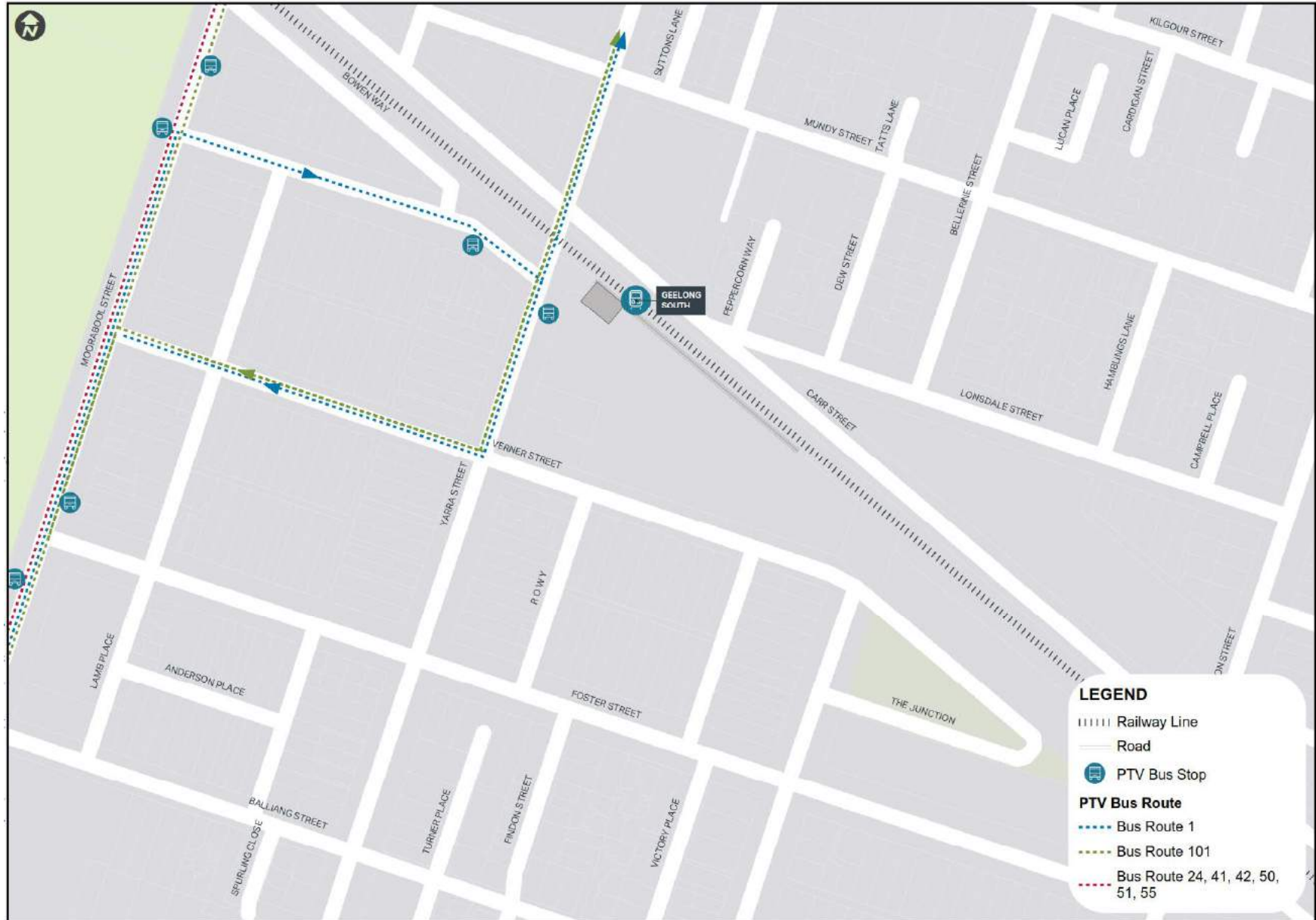


Figure 20 South Geelong Station – Bus Routes and Stops



1.1.6 Marshall Station

The existing conditions at Marshall Station are provided in Table 6 and referred to figures.

Table 6 Existing conditions – Marshall Station

Item		Description
Station Accessibility	Services	Marshall Station consists of a single platform which provides V/Line services to Waurin Ponds, Southern Cross and Warrnambool. The station has a station building and is staffed part time.
	Platform Access	Two access points onto the platform
	Vehicle Access	Station accessed via a priority intersection with Marshalltown Road. The access is located approximately 20m east of the Marshalltown Road level crossing. See Figure 21.
	Walking	All local streets have footpaths provided. A dedicated pedestrian path is provided to the along the eastern side of the rail line. See Figure 22.
	Cycling	No bicycle infrastructure in the immediate area. Marshall Town Road and Drews Road are part of the PBN as shown on Figure 23.
	Bus	Serviced by bus routes 40, 50, 51 and 55. See Figure 24.
Station Facilities	Car parking	A total of 455 car parking spaces are provided, with 433 having no restrictions (of which approximately 55 spaces are provided on an informal gravel parking area). There are 12 kiss and ride spaces and seven disabled parking bays provided. See Figure 21.
	Bus facilities	Bus stop is provided directly opposite the station with 3 bus bays provided.
	Kiss and Ride	Two two-minute and 10 10-minute bays provided in the immediate proximity of the station. See Figure 21.
	Bicycle facilities	Bicycle loops with capacity for three bicycles. A Parkiteer Cage is present with capacity for 26 bicycles (12 loops and 14 hanging).
	Taxi facilities	One taxi bay
	Wheelchair accessible	Yes. Ramp to access platform
	Tactile paths	Yes
	Hearing loop	Yes
On-street carparking		No associated on-street parking

Figure 21 Marshall Station – Vehicle Access and Car Parking

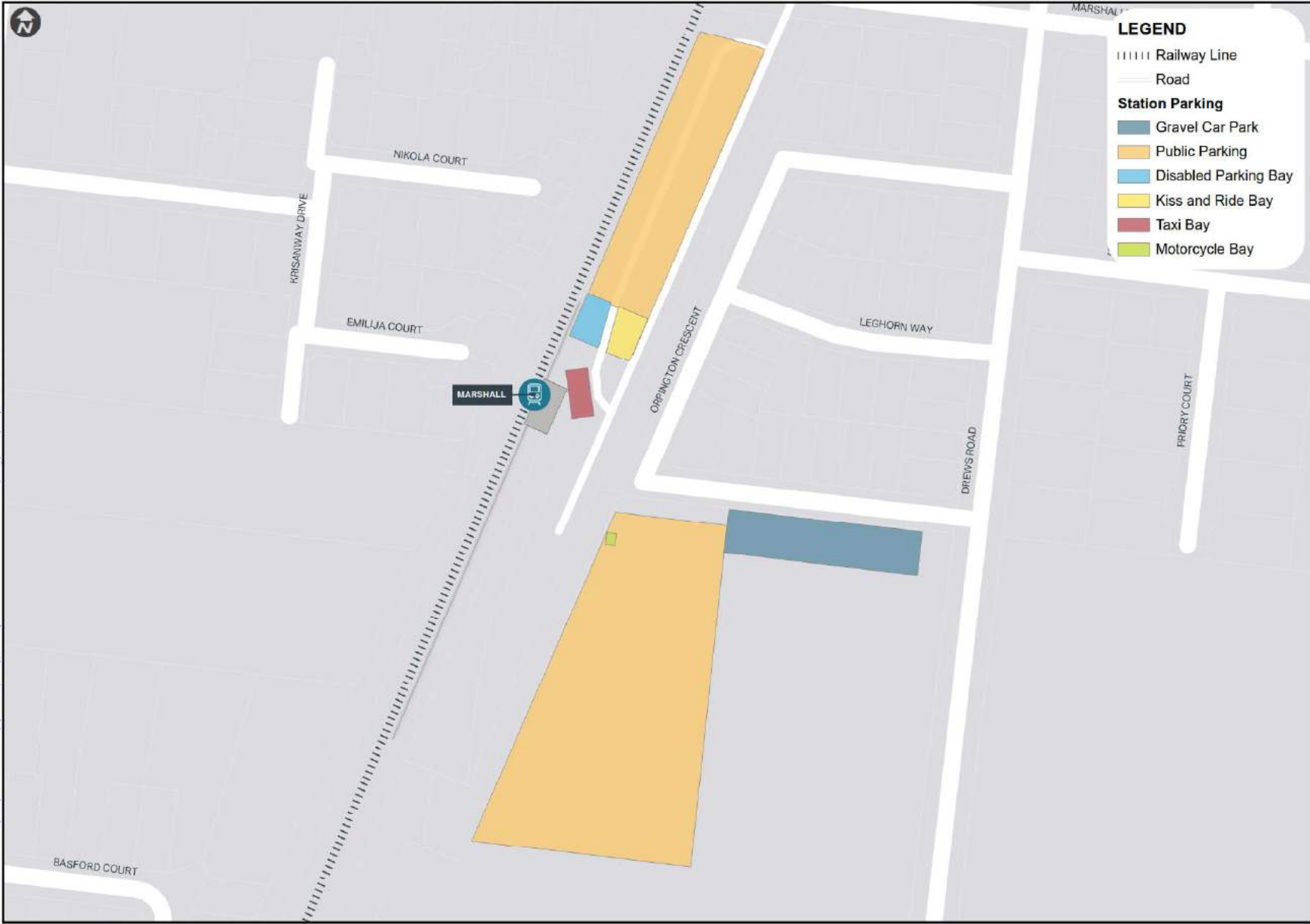


Figure 22 Marshall Station – Pedestrian Provision

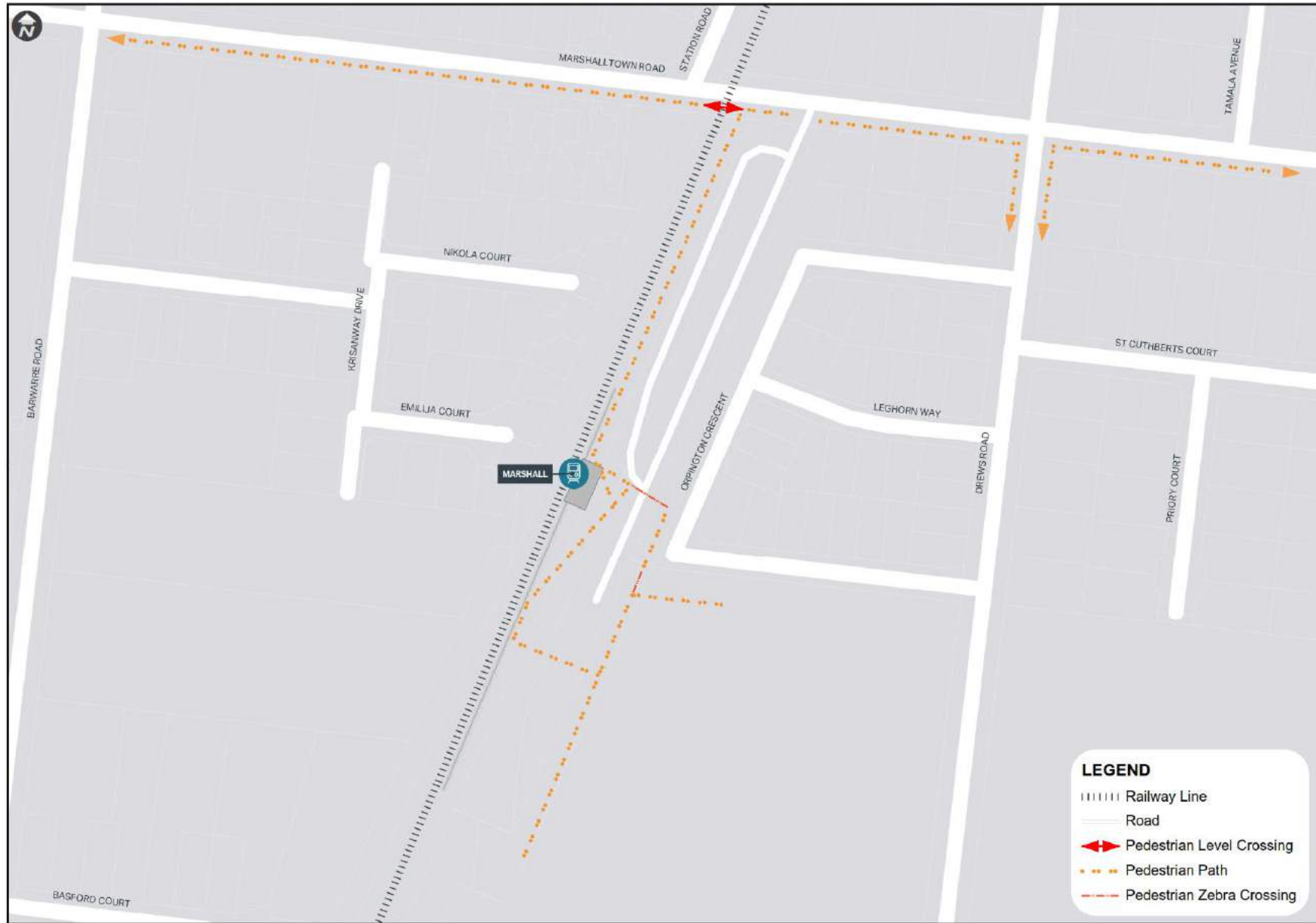


Figure 23 Marshall Station – Bicycle Provision

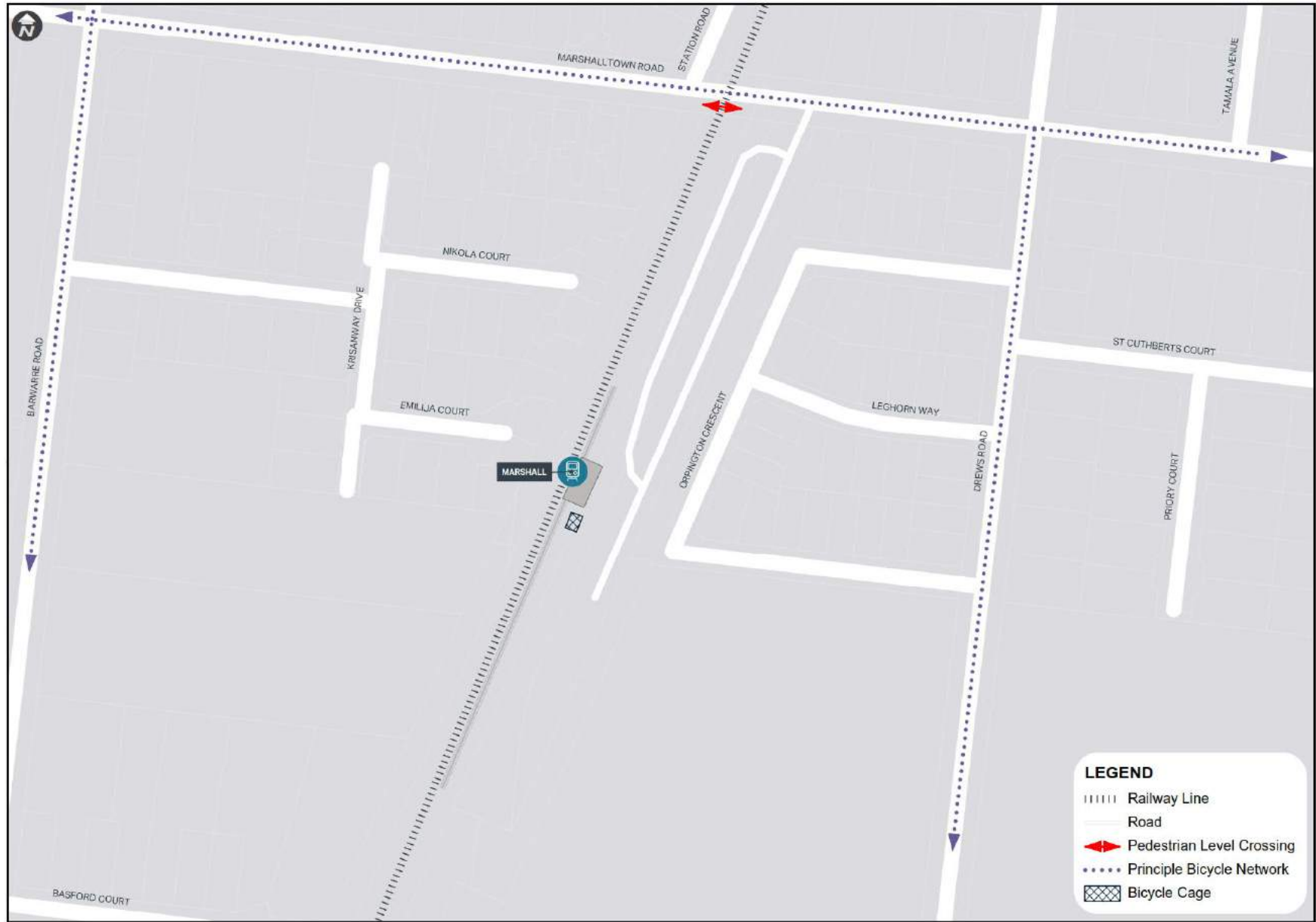
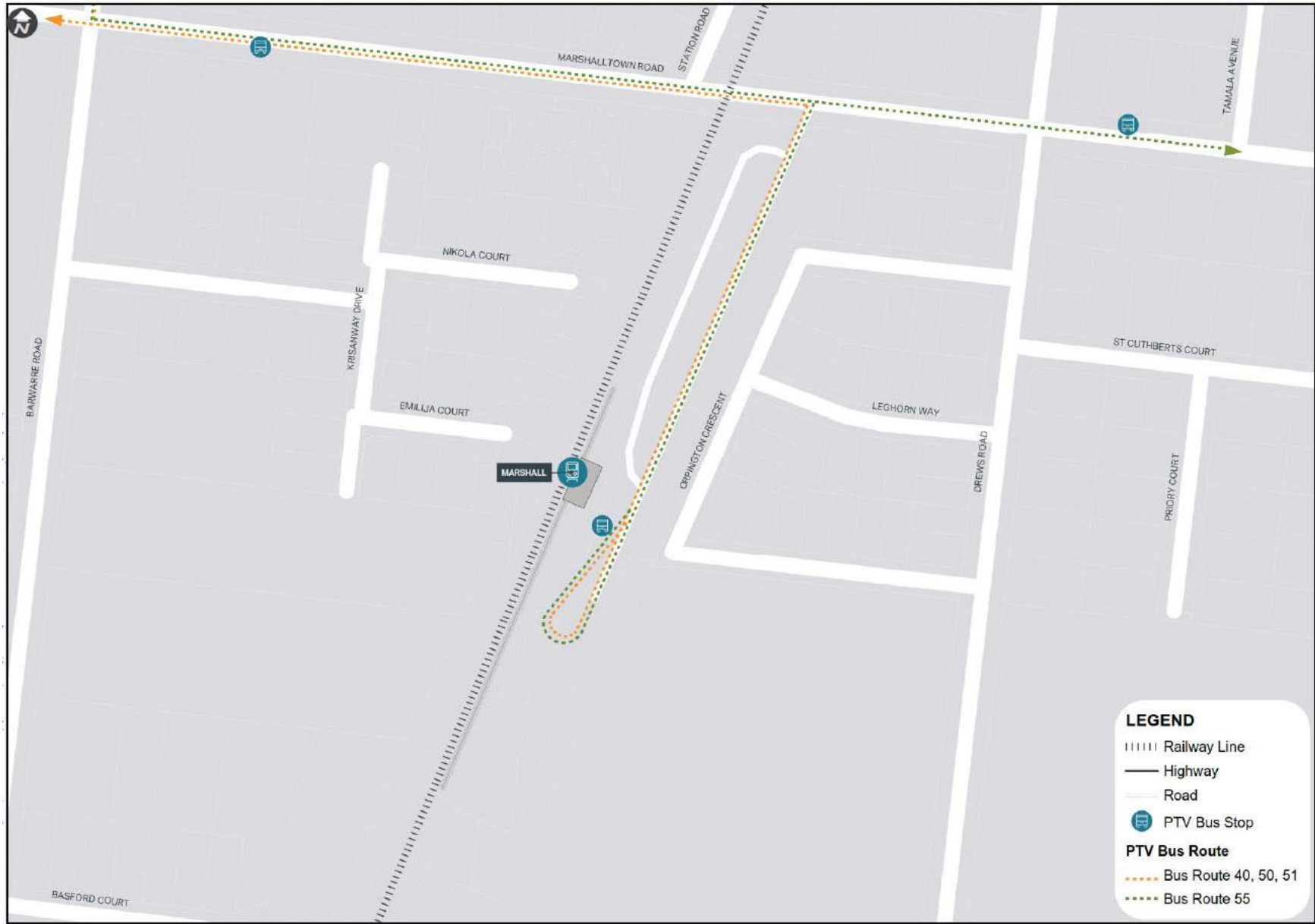


Figure 24 Marshall Station – Bus Routes and Stops



1.1.7 Waurm Ponds Station

The existing conditions at Waurm Ponds Station are provided in Table 7 and referred to figures.

Table 7 Existing conditions – Waurm Ponds Station

Item		Description
Station Accessibility	Services	Waurm Ponds Station consists of a single platform which provides V/Line services to Southern Cross and Warrnambool. The station has a station building and is staffed.
	Platform Access	Four access points onto the platform (one via the station building and three via the carpark)
	Vehicle Access	The station carpark is accessed via the Sugargum Drive / Bodega Street roundabout. See Figure 25.
	Walking	All local streets have footpaths provided, with those locally to the station offset by grassed verge from the road. Zebra crossings are provided across Sugargum Drive for access to and from the provided bus stops. See Figure 26.
	Cycling	No bicycle infrastructure in the immediate area. Bodega Street is part of the PBN as shown on Figure 27.
	Bus	Serviced by bus routes 41 and 42, see Figure 28.
Station Facilities	Car parking	A total of 301 car parking spaces are provided, which include 279 spaces with no restrictions, seven kiss and ride spaces, five disabled, four motorcycle spaces and the remainder being a mixture of permit and no stopping (authorised vehicles excepted) spaces. See Figure 25. VicTrack recently completed the formalising of 50 gravel car parking spaces.
	Bus facilities	Bus stops are provided directly opposite the station on Sugargum Drive as shown on Figure 28
	Kiss and Ride	Two two-minute and three five-minute bays provided in immediate proximity of the station. See Figure 25.
	Bicycle facilities	Bicycle spirals with capacity for nine bicycles. A Parkiteer Cage is present with capacity for 21 bicycles (6 loops and 15 hanging).
	Taxi facilities	None
	Wheelchair accessible	Yes. Platform at-grade
	Tactile paths	Yes
	Hearing loop	No
On-street carparking		No associated on-street parking

Figure 25 Waurn Ponds Station – Vehicle Access and Car Parking

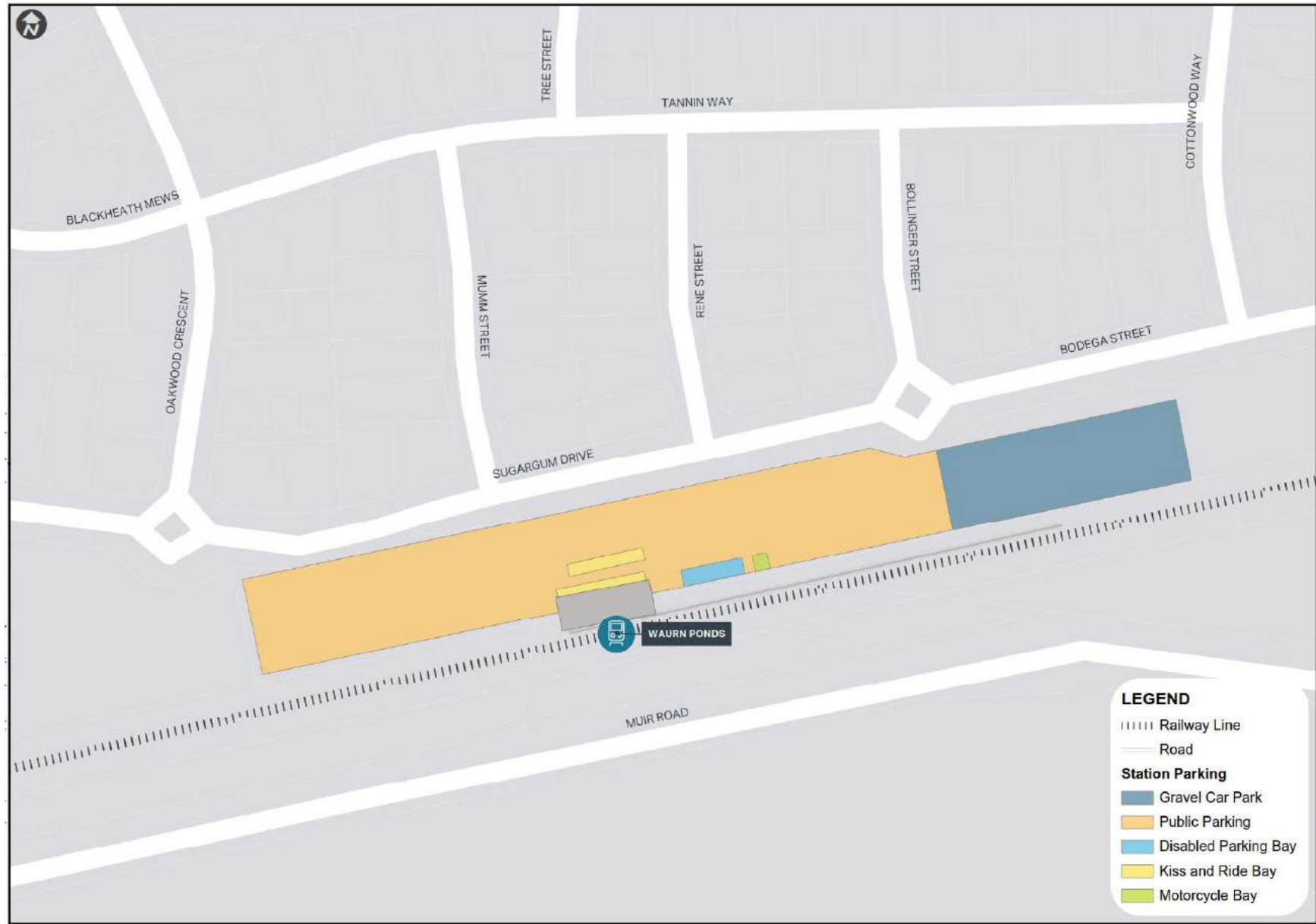


Figure 26 Waurn Ponds Station – Pedestrian Provision

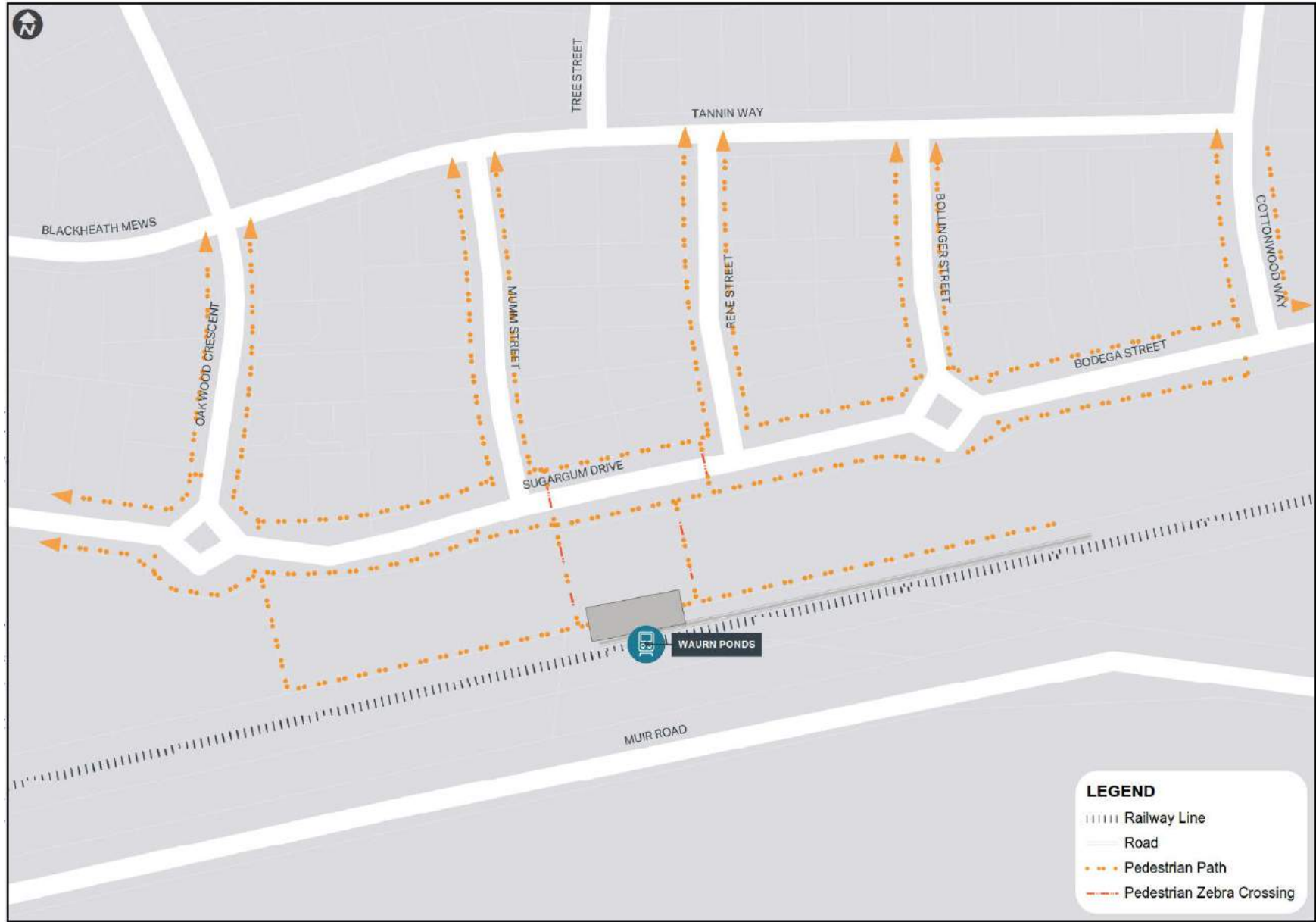


Figure 27 Waurm Ponds Station – Bicycle Provision

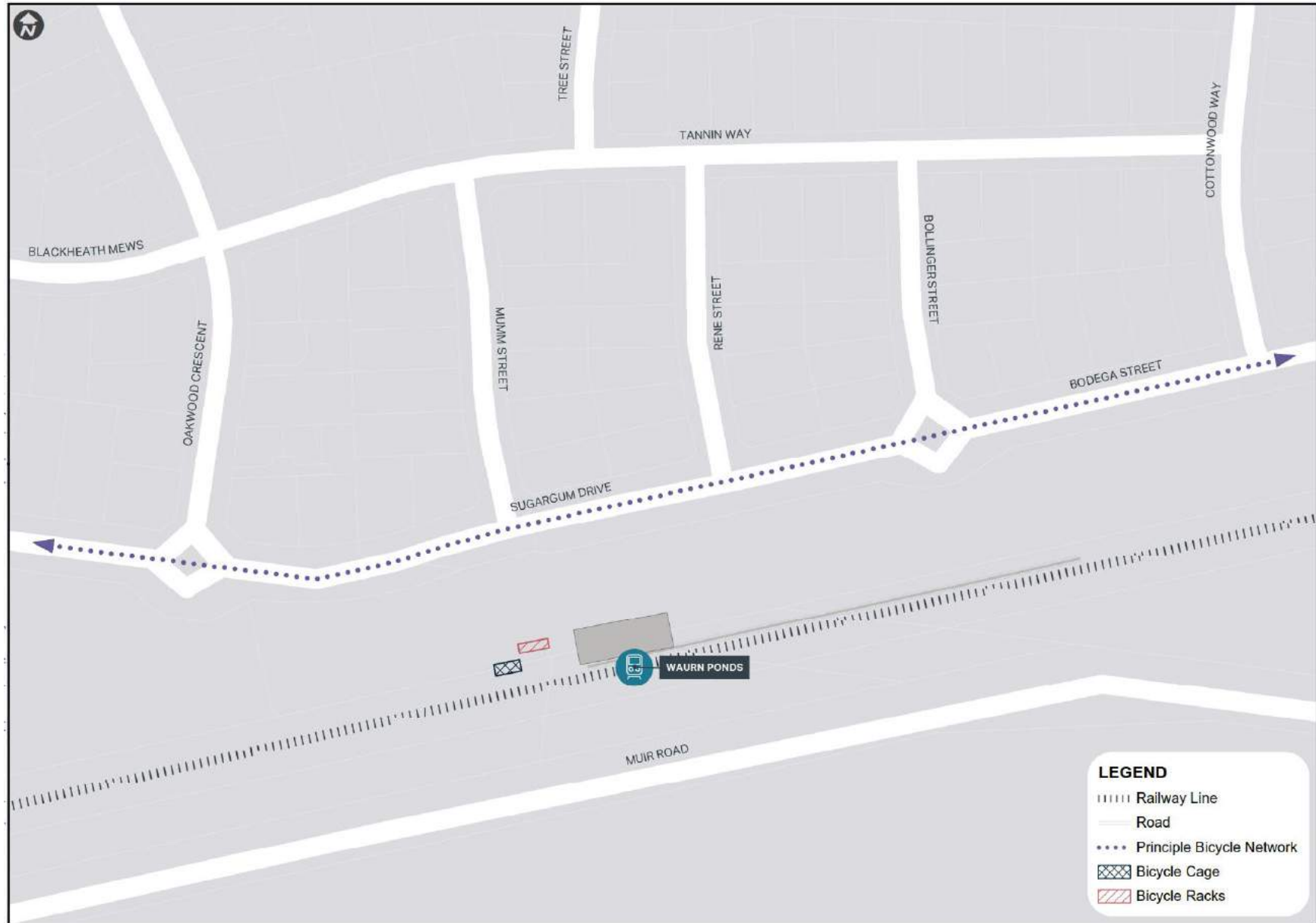
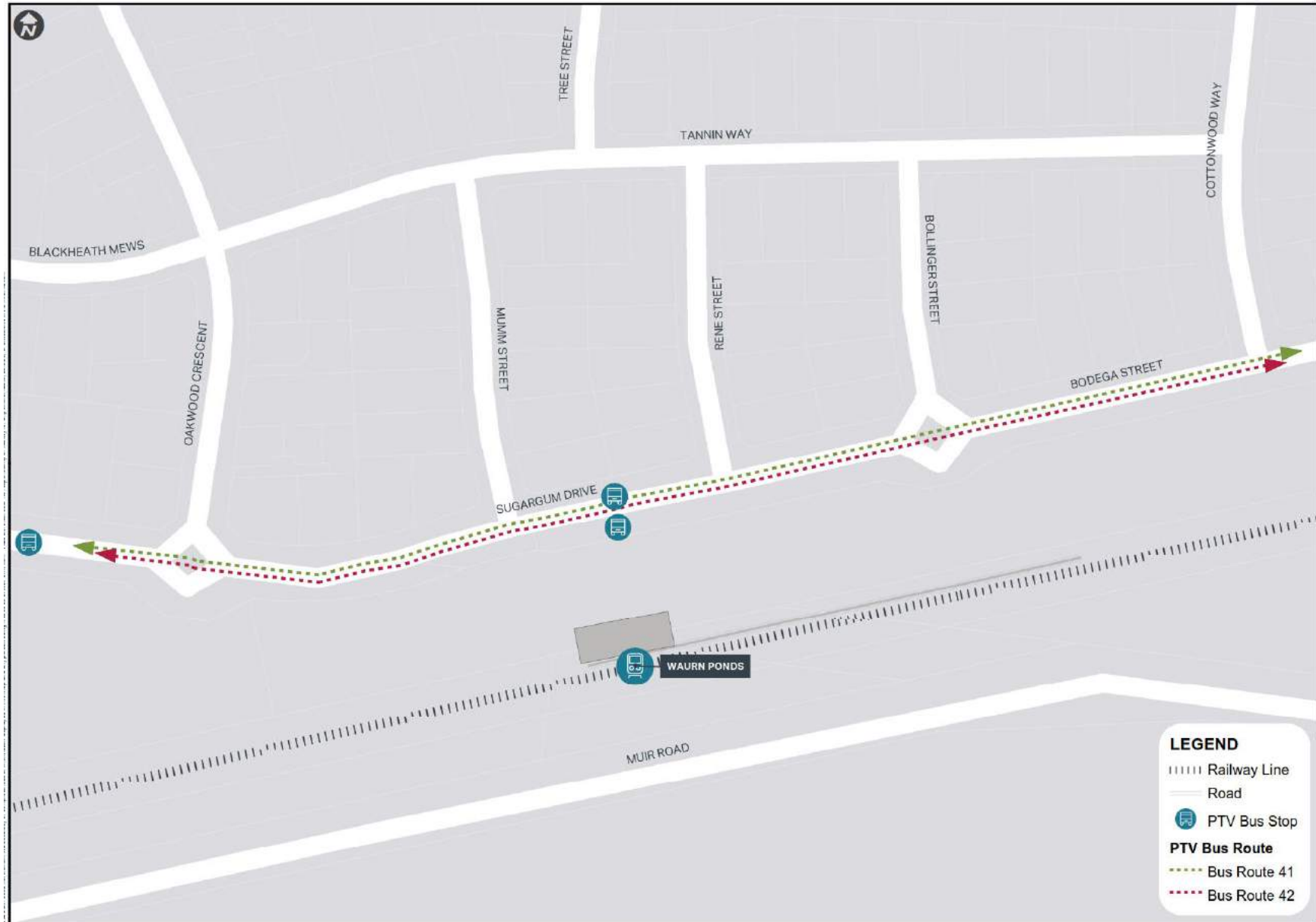


Figure 28 Waurn Ponds Station – Bus Routes and Stops



1.2 Undeveloped land

A summary of the undeveloped land review at each of the study stations is provided in Table 8. Planning overlays, zoning maps and VicTrack land boundaries for the study stations are provided in **Error! Reference source not found..**

Table 8 Undeveloped land summary

Station	Land review	Land for future commuter parking
Lara	VicTrack land boundary extends to the north-east of the existing station / parking area and is currently vacant. The area is zoned PUZ4 public use transport. No flooding overlays are present.	The most suitable land to be used for future car parking is immediately to the north-east of the existing carpark. This is VicTrack land and would not require any re-zoning.
North Shore	VicTrack land boundary is constrained with some land available abutting the rail line to the west and an area of land which is leased on the eastern side of the rail corridor. The area is zoned PUZ4 public use transport. No flooding overlays are present.	The most suitable land to be used for future car parking is immediately north of the existing carpark which is vacant VicTrack land and requires no rezoning.
North Geelong	VicTrack land boundary extends to the north of the existing North Geelong parking area on the western side of the rail corridor. The area is zoned PUZ4 public use transport. No flooding overlays are present.	Most suitable land to be used for future carparking is to formalise the car park to the north or use the vacant Department of Finance and Treasury land. The vacant DFT land is the previous "North Geelong Gasworks" and currently is contaminated land which is vacant and unused. DFT are looking to repurpose this land.
Geelong	VicTrack land boundary is constrained. No flooding overlays are present.	No undeveloped land that may be suitable for carparking owned by VicTrack or others given built up central Geelong area.
South Geelong	The VicTrack land boundary is constrained. Vacant land to the south of the existing recently sealed car park is classified EAO (environmental audit) in the planning overlay. No flooding overlays are present.	The most suitable land to be used for future carparking is the land with EAO to the south of the existing gravel carpark. Otherwise the Barwon Water Land is undergoing rezoning. However, the South Geelong to Waurn Ponds rail study and the Urban Design Framework for South Geelong station could further inform options to accommodate future parking demand.
Marshall	The VicTrack land boundary extends over a large parcel of land to the south and east of the existing southern car park. The zoning of land does not seem correct according to the footprint of the car park, the vacant land is designated UGZ – Urban Growth, however some of this land has already been developed on for station car parking. No flooding overlays are present.	The most suitable land to be used for future carparking is to the east, west or south of the existing southern carpark as this land is owned by VicTrack, however it is zoned as UGZ – Urban Growth so verification of future development will be required.
Waurn Ponds	VicTrack land boundary extends further east of the existing car park up to the Bodega Street roundabout.	The most suitable land to be used for future carparking is to the east of the existing carpark as this is VicTrack land and requires no rezoning.

1.3 Planned development

A review of planned development in the vicinity of the study stations has been conducted with a summary of this assessment provided in **Table 9**.

Table 9 Planned development summary

Station	Planned development
Lara	The Lara Structure Plan April 2011 noted the potential to develop an intermodal transport facility on the privately-owned site at the north-east end of Lara, which is located north-west adjacent to the Station. A pedestrian overpass with lifts was also proposed.
North Shore	RNDP – North Shore Station additional bus shelter and associated lighting to be completed by the end of November 2018
North Geelong	
Geelong	Geelong Station Precinct Land Use and Development Strategy (underway): Redevelopment of Geelong Station, it is currently a draft only and yet to be formally considered. However, this plan includes the removal of long-term parking at Geelong Station and a complete overhaul of the station's access and facilities. This commuter car parking study supports the intent of removing the commuter car parking at Geelong station and investigates options to accommodate the spillover car parking at the remaining railway stations. Bus and taxi shelter improvements and PID installation are underway and are expected to be completed by early December 2018 under the Vic Track Road and rail minor works program which was an outcome of the Regional Network Development Plan.
South Geelong	Wauron Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong. • Duplication of rail track between South Geelong and Wauron Ponds Stations. • Shared path along the corridor between South Geelong and Wauron Ponds Station. <p>Barwon Water Land Redevelopment (2018): Barwon Water are vacating a landholding situated to the north of South Geelong Station and this land is to be re-zoned. A precinct plan for the area surrounding South Geelong Station by City of Greater Geelong is currently underway. Barwon Water board does not support this land being used for additional carparking which has informed the option to build a car parking structure at this station to accommodate the redistributed commuter car parking from Geelong station.</p>
Marshall	Wauron Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong • Duplication of rail track between South Geelong and Wauron Ponds Stations • Shared path along the corridor between South Geelong and Wauron Ponds Station <p>VicTrack have formalised the gravel carpark present to the east of the existing formal carpark with 50 extra carparks and extended platform shelters at Marshall Station.</p>
Wauron Ponds	Regional Rail Revival - Geelong Line Upgrade - an additional platform and pedestrian link at Wauron Ponds Station as well as rail track to enable trains to pass each other (funded). Wauron Ponds Duplication Stage 2 (2018/19) includes: <ul style="list-style-type: none"> • Upgrade and second platform at South Geelong and Marshall • Duplication of rail track between South Geelong and Wauron Ponds Stations • Shared path along the corridor between South Geelong and Wauron Ponds Station

Appendix B

Existing Station Usage

Appendix B – Existing Station Usage

This appendix outlines the existing station usage characteristics which have been informed via commissioned surveys.

1.1 Survey scope

AECOM commissioned a sub-consultant, Matrix Traffic and Transport Data, to undertake a range of surveys to identify the usage characteristics of each station. A summary of the surveys undertaken are outlined in Table 1.

Table 1 Survey summary

Usage characteristics	Survey type	Survey date and time periods
Station inventory	On-site observations	Various
Car parking occupancy (including kiss and ride, bus bays and bicycle)	Car Park Survey, manual person surveys	Tuesday 27 th March 2018 - morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) commuter periods. Monday 2nd April 2018, event day (10:30 am – 2:30 pm). Tuesday 5 th June 2018 - morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) commuter periods (resurvey of Geelong station and all stations for bicycle parking occupancy).
Parking user observations		Tuesday 27 th March 2018 - morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) commuter periods
Kiss and ride utilisation counts – Geelong Station	Video camera	Thursday 19 th April 2018 – 13-hours from 6:00 am to 7:00 pm
Station gate arrival / departure surveys		
Mode share of commuter trips	Questionnaire (face to face on-site)	Tuesday 27 th March 2018 - morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) commuter periods
Parking habits of commuters		
Origin and destination of commuters		
Trip purpose of commuters		
Demographic information of commuters		
Generic question on opinions for station / local access improvements		

Analysis of each station is subsequently provided along with a comparative analysis of the usage characteristics across the study corridor.

1.2 Lara Station existing usage

1.2.1 Car parking

1.2.1.1 Off-street parking

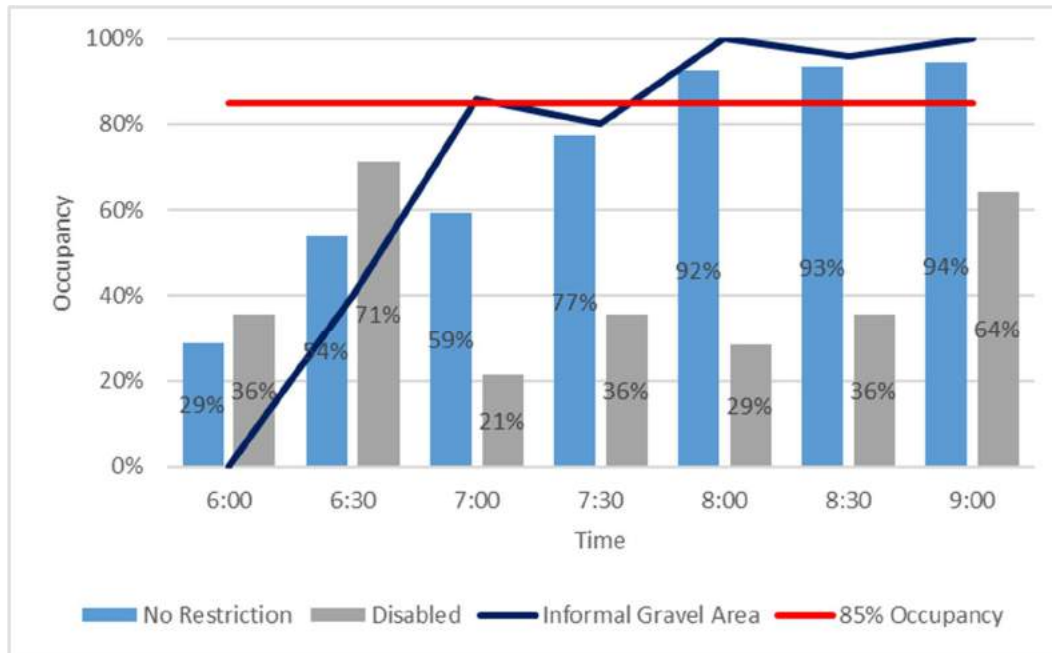
A total of 602 off-street carparking spaces were recorded for Lara Station. These consist of:

- 575 car parking spaces with no restrictions.
- Three 'five-minute' kiss and ride spaces.
- 14 disabled spaces.

In addition, it was observed that the gravel area to the north-east of the off-street carpark is used informally by commuters. The parking capacity in this area was observed on site to cater for 50 cars.

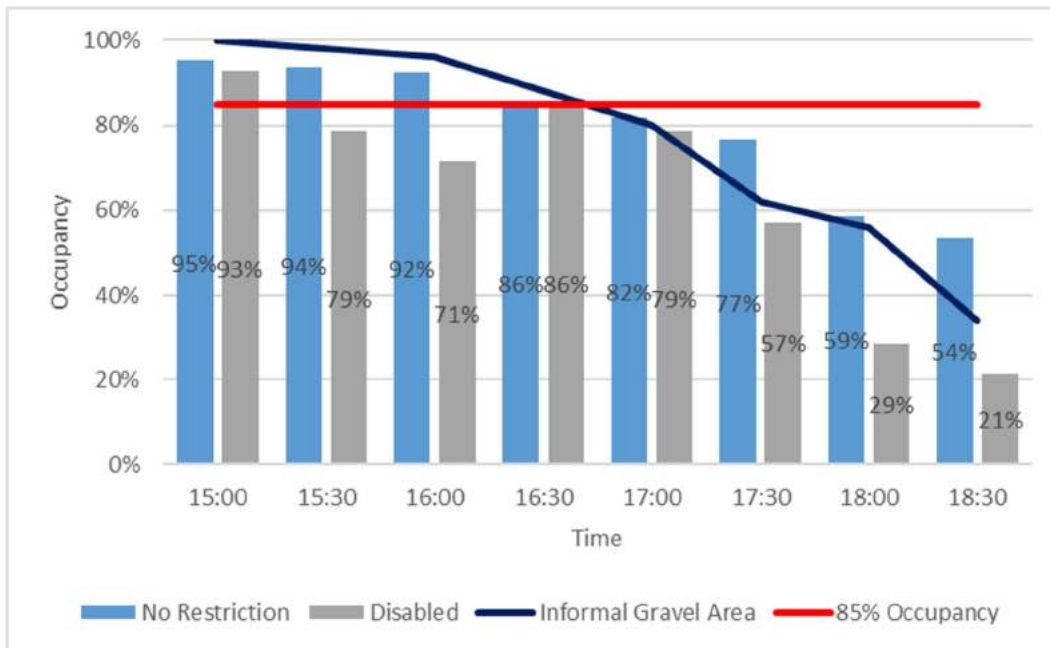
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 1 and Figure 2.

Figure 1 Lara Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 2 Lara Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 1 and Figure 2:

- 93% (562 of the 602-space occupied, with only 40 spaces available) of parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey.
- By the commencement of the evening peak occupancy survey 95% of available parking spaces were occupied, with only 30 spaces available.
- Disabled parking provision was almost all occupied with 93% (13 of the 14) of spaces occupied at 3:00 pm.
- The informal gravel area was being utilised for parking before the formal car parking area was close to capacity, it was fully occupied at 8:00 am.

Table 2 provides a summary of the supply and demand of parking spaces for the off-street carpark at Lara Station.

Table 2 Overview of Supply and Demand of off-street carparking spaces at Lara Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	585	558	95%	15:00	249	43%	13:30
Disabled	14	13	93%	15:00	1	7%	12:30 – 14:30
P5 minutes	3	3	100%	17:30 – 18:30	2	67%	11:00, 13:00, 14:30
Total formal car parking	602	572	95%	15:00	251	42%	13:30
Informal gravel car parking area	50	50	100%	8:00, 9:00, 15:00	0	0%	-
Total car parking	652	622	95%	15:00	251	42%	13:30

It can be noted from Table 2 that the formal carpark at Lara Station was surveyed to be operating at a maximum of 95%, with the informal gravel parking area being at 100%.

1.2.1.2 On-street parking

A total of 54 on-street car parking spaces were recorded to be near Lara Station, with the following provided:

- 29 spaces located on Hicks Street with eight unrestricted and 21 with 1/4P time restrictions.
- 25 spaces located on Bates Road with 10 unrestricted and 13 with 1/4P time restrictions.

The occupancy survey results of the on-street car parking near Lara Station on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 3 and Figure 4. As shown there is spare on-street parking supply, however this would notably be due to the time restrictions put in place to deter overspill Lara Station car parking.

Figure 3 Lara Station on-street car parking occupancy – morning peak period (6:00am to 9:30am)

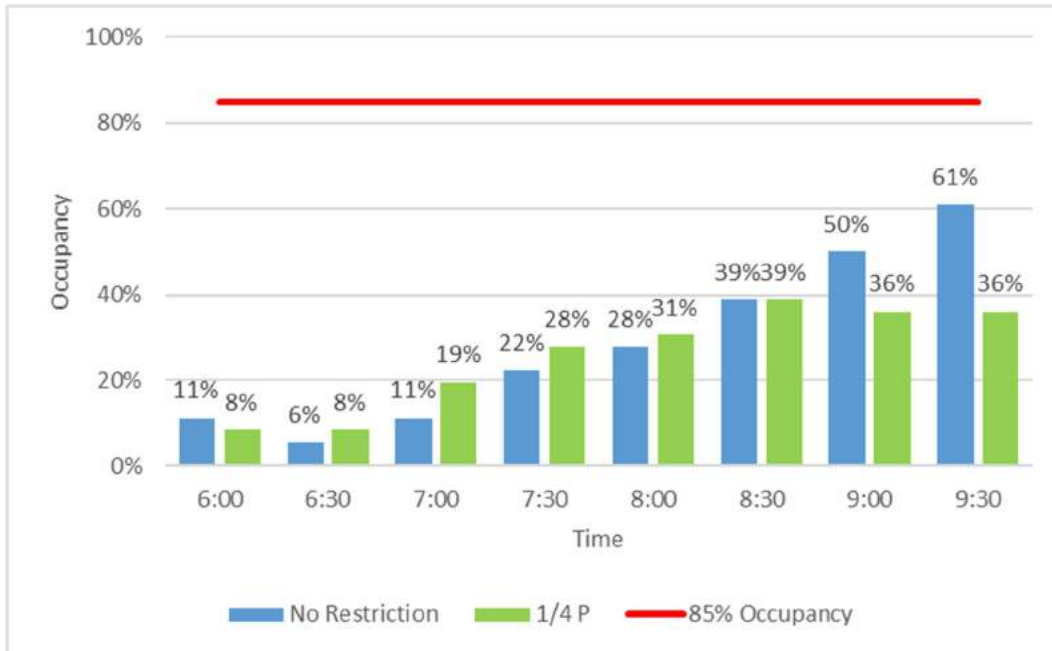
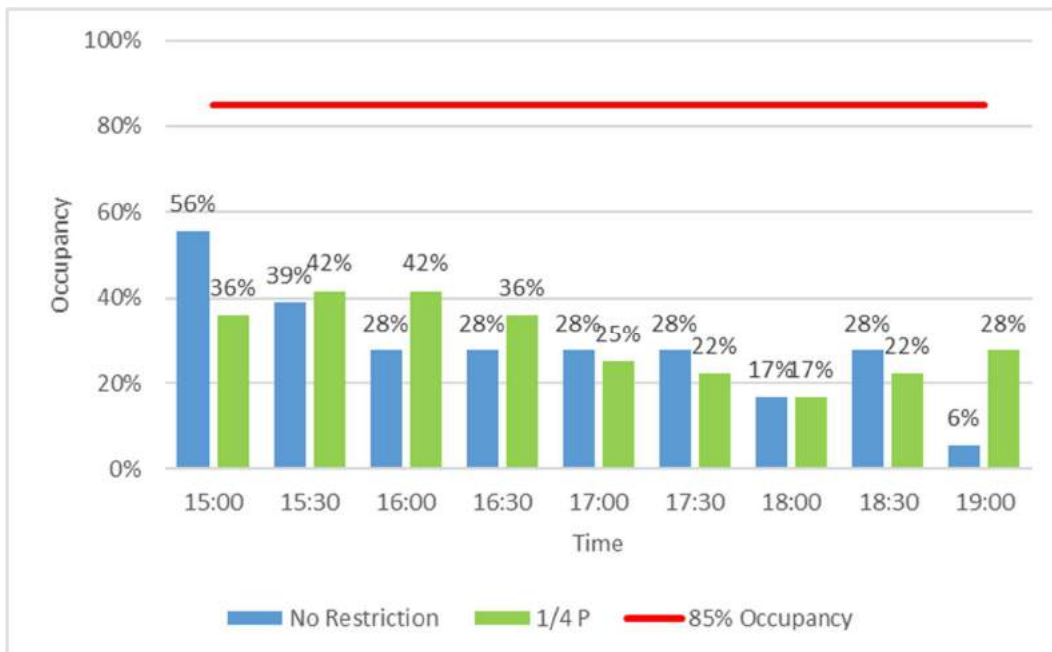


Figure 4 Lara Station on-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Table 3 provides a summary of the supply and demand of parking spaces for the on-street car parking near Lara Station.

Table 3 Overview of Supply and Demand of on-street carparking spaces local to Lara Station

Street Name	Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
			Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
Hicks Street – West Side	No Restriction	4	2	50%	8:30 till 9:30	2	50%	11:30 till 12:30 and 13:00 till 14:00
Hicks Street – East Side	No Restriction	4	3	75%	9:30 & 17:00	3	75%	11:30 till 13:00
	1/4 P	21	10	48%		8	38%	11:30 & 12:30 till 13:30
Bates Road – North Side	1/4 P	15	6	40%	8:30, 15:30 & 16:00	9	60%	14:00
Bates Road – South Side	No Restriction	10	6	60%	9:30	8	80%	12:30 till 13:30
Total parking		54	24	44%	9:30	26	48%	13:00

As shown from Table 3 some of the no restriction spaces are potentially used by commuters when parking capacity in the off-street area exceeds 85%, since peak occupancies occur after 8:30 am. It is unclear from the data if those parking in the 1/4 P spaces doing so legally as no parking duration surveys were undertaken to confirm this.

1.2.2 Car parking user observations

Surveys showed that all users of the Lara Station off-street car park did so to use the station.

1.2.3 Bicycle parking

Lara Station has capacity for a total of 24 bicycles split between loops (18) and lockers (6).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 4 and Table 5.

Table 4 Lara Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	18	5	8	10	12	12
	Lockers	6	0	0	0	0	0
	Total	24	5	8	10	12	12
	% Occupancy			21%	33%	42%	50%
Informal bicycle parking			0	0	0	0	0

Table 5 Lara Station – Supply and demand bicycle parking, PM peak

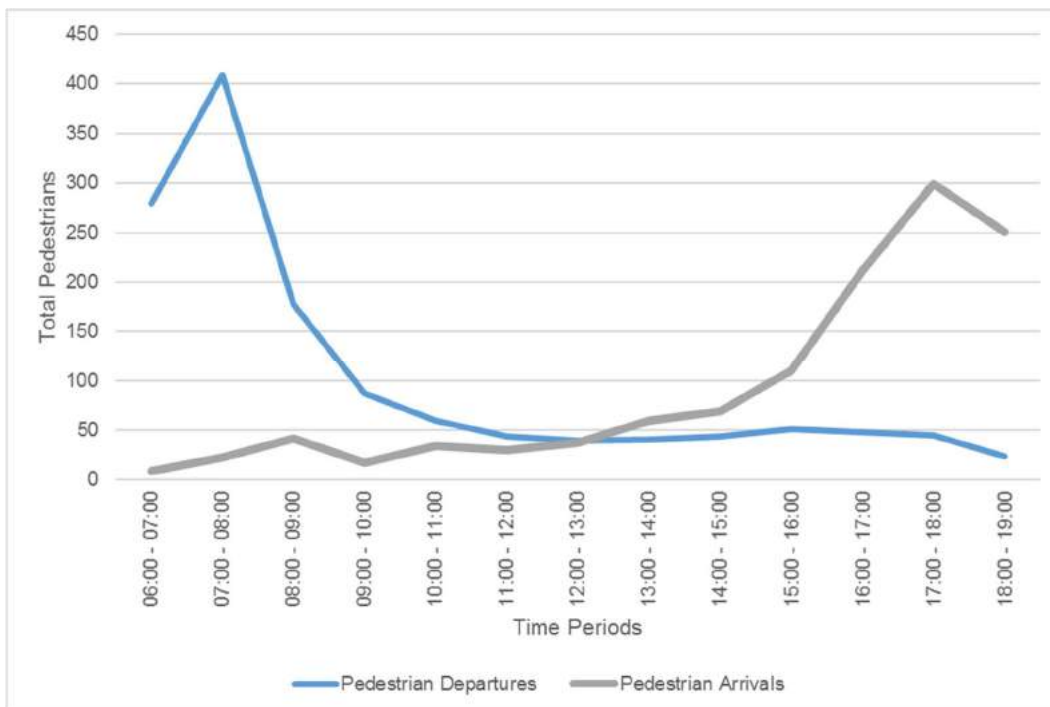
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	18	11	11	10	5	3
	Lockers	6	0	0	0	0	0
	Total	24	11	11	10	5	3
	% Occupancy			46%	46%	42%	21%
Informal bicycle parking			1	1	1	1	0

As shown from Table 4 and Table 5, there is sufficient bicycle parking capacity at Lara Station to meet current demand, with the peak bicycle parking occupancy being at 50 percent, yet the imbalance in use between loops and lockers may suggest expansion of the former as more cycling is encouraged.

1.2.4 Station gate volumes

The pedestrian arrivals and departures at Lara Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours) at the pedestrian level crossing, which is the single access point to both platforms. The pedestrian flow profile over the surveyed period is shown in Figure 5.

Figure 5 Lara Station – Pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 5:

- A total of 2,536 pedestrians travelled via Lara Station over the total survey period.
- A total of 431 pedestrians (409 departing and 22 arriving) were recorded during the morning peak period between 7:00 and 8:00 departing from Lara Station.
- A total of 344 pedestrians (45 departing and 299 arriving) were recorded during the evening peak period between 17:00 and 18:00 arriving at Lara Station.

1.2.5 Questionnaire survey findings

The questionnaire surveys at Lara Station received responses from 80 commuters in the AM period and 63 in the PM period.

1.2.5.1 Demographics

Survey respondents were:

- Primarily between the ages of 30-49 years old at 41%, the second largest age group were between 18-29 at 34%.
- 56% male and 44% females in both the morning and evening survey periods.
- Primarily full-time workers at 45% in the morning period and 48% in the evening period. Students being the second largest group with 40% in the morning period and 25% in the evening period.
- Primarily travelling for work purposes in the morning period at 66%, with 28% travelling for education purposes. In the evening peak period 52% of respondents were travelling for 'other' reasons with only 23% for work and 16% for education purposes.

1.2.5.2 Mode share

The mode choice by the survey respondents on how they travelled to Lara Station is shown in Figure 6. The reason of selection of this travel mode is shown in Figure 7 and Figure 8 for the morning and evening surveyed periods respectively.

Figure 6 Lara Station – commuter modes

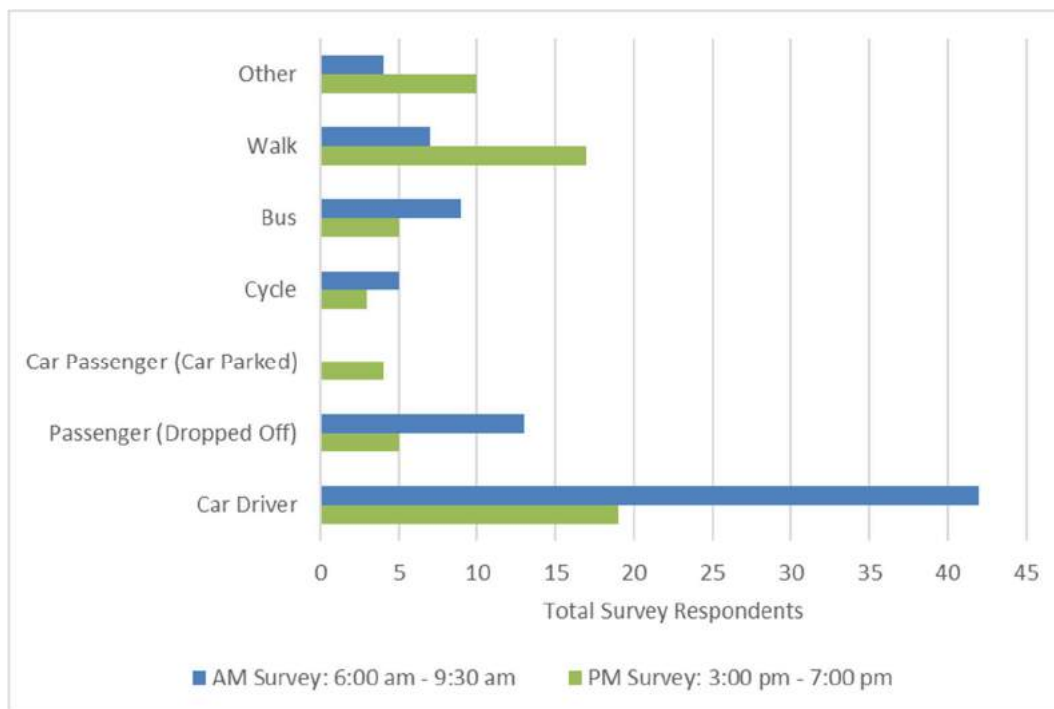


Figure 7 Lara Station – commuter mode choice – morning peak

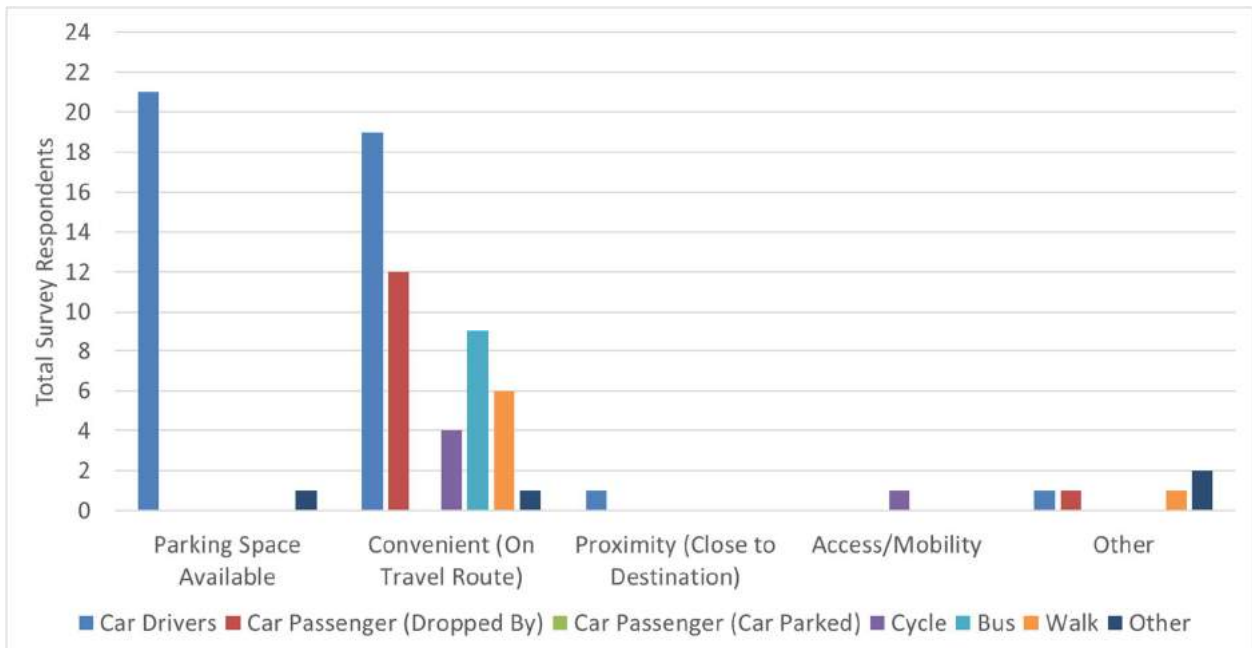
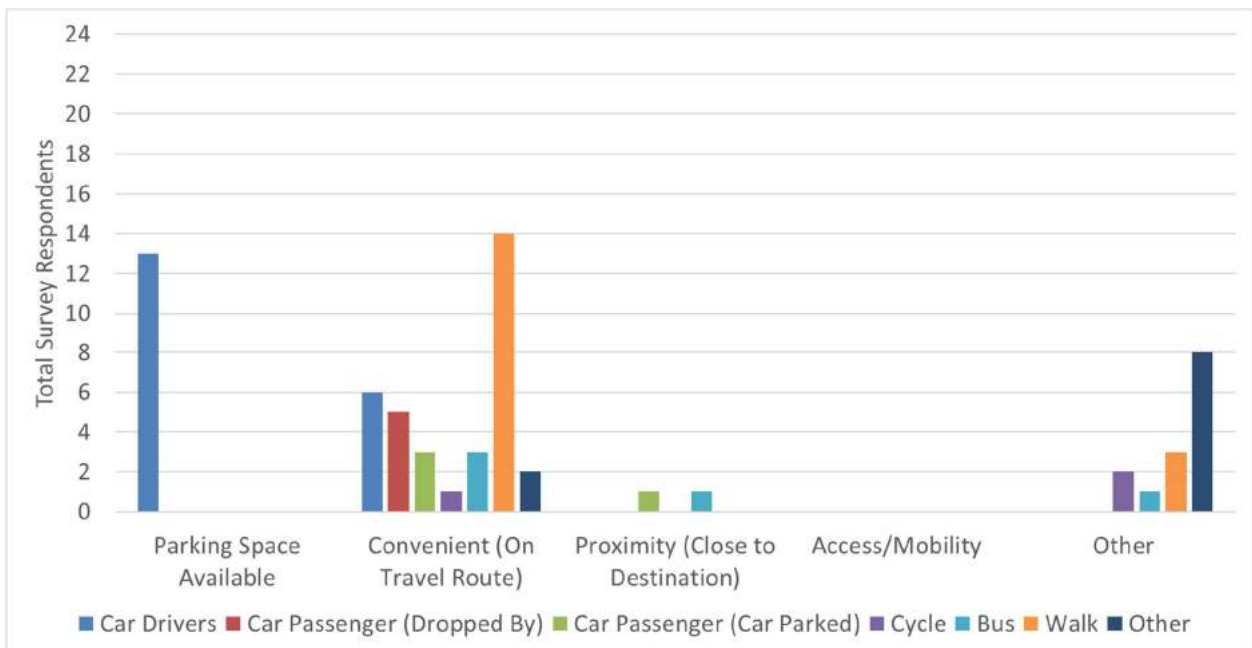


Figure 8 Lara Station – commuter mode choice – evening peak



The following can be noted from the Lara Station travel mode selection:

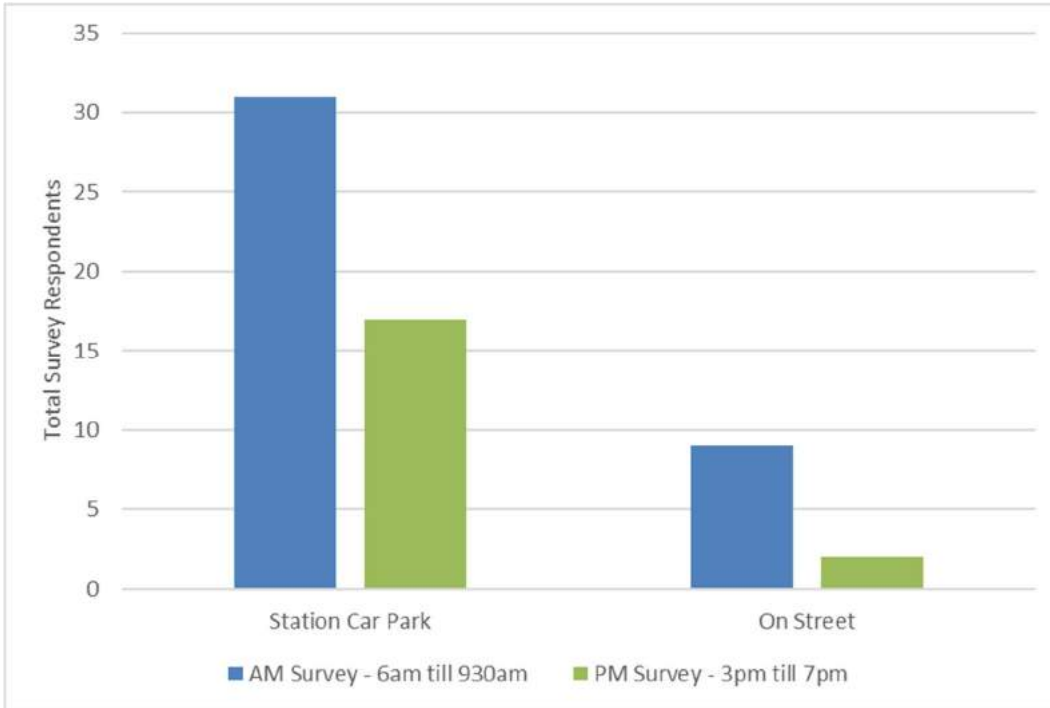
- 69% of commuter’s travel to Lara Station by car in the surveyed morning period with 53% being car driver and 16% being dropped off. With the main reasoning behind car use being the availability of car parking and convenience.
- Only 38% of commuter’s travel to/from Lara Station by car in the surveyed evening period, with a higher proportion of commuters choosing to walk or use other means of transport (43%), this is likely the need to travel due to more recreational activities.

Main reason behind car usage was the availability of car parking spaces in the evening survey period, with walking due to the local convenience of Lara Station.

1.2.5.3 Commuter parking habits

The parking habits of commuters to Lara Station is provided in Figure 9. As shown the majority parked in the off-street station car park. However, nine respondents did state that they parked on-street in the morning peak period.

Figure 9 Lara Station – Commuter parking location

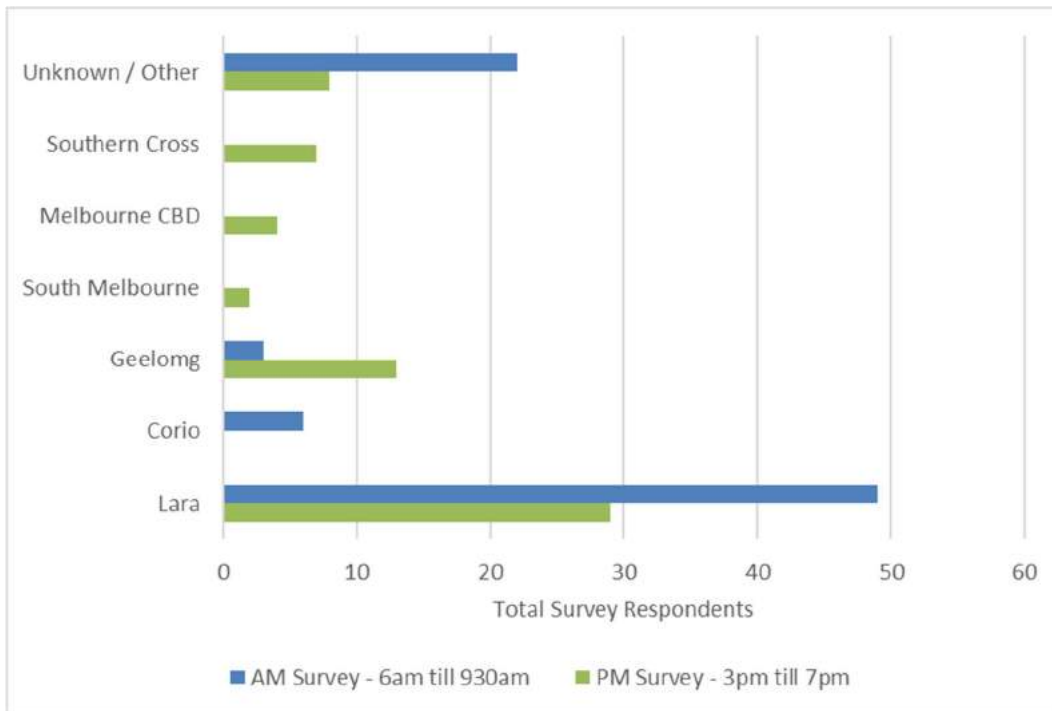


1.2.5.4 Lara Station commuter travel findings

The following figures show the Lara Station commuter travel origins/destination, travel purpose and times:

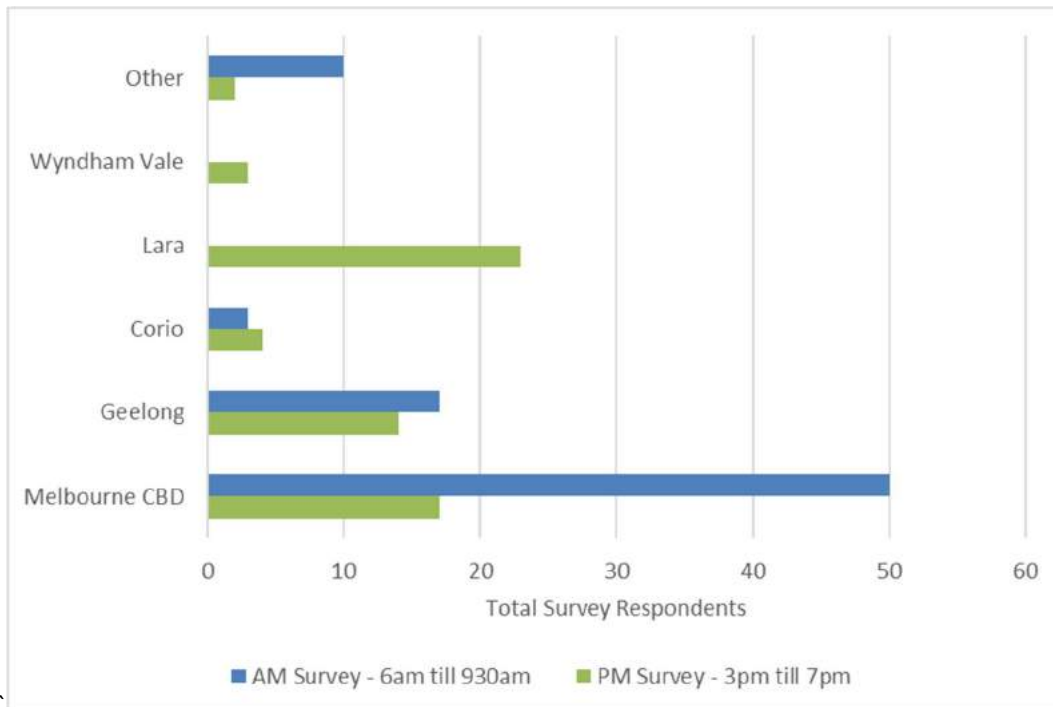
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 10 and Figure 11.
- The respondents travel purposes are surmised in Figure 12.
- The respondents indicative travel times are outlined in Figure 13.

Figure 10 Lara Station commuter Origins – AM and PM survey periods



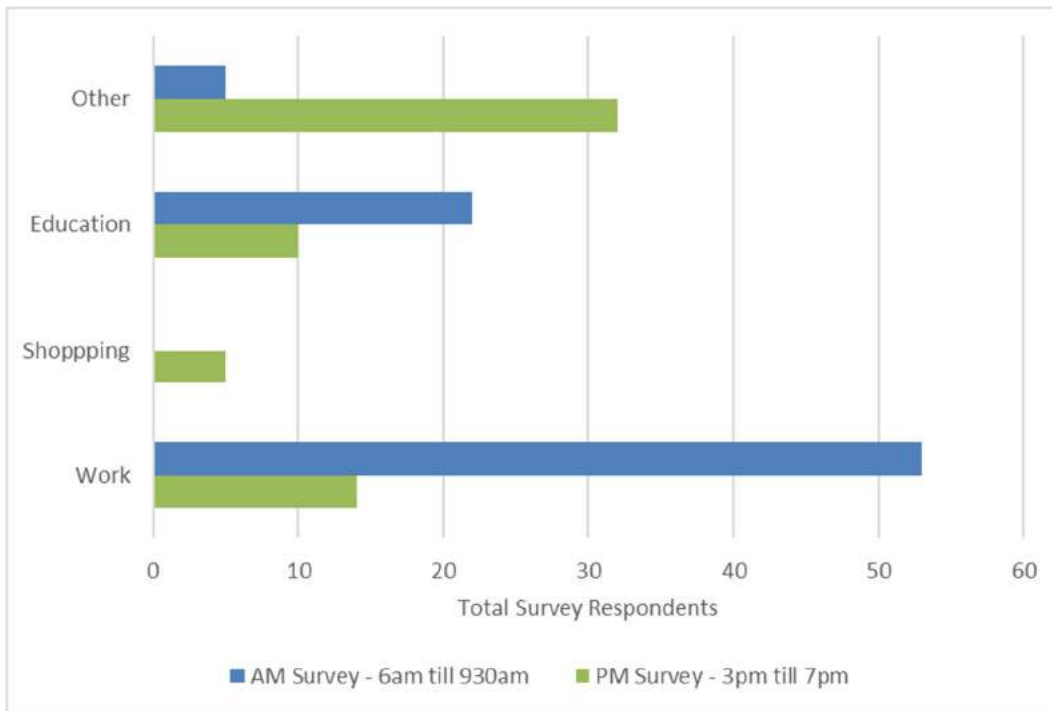
As shown most commuters originate from Lara in both the morning and evening survey periods.

Figure 11 Lara Station commuter destinations – AM and PM survey periods



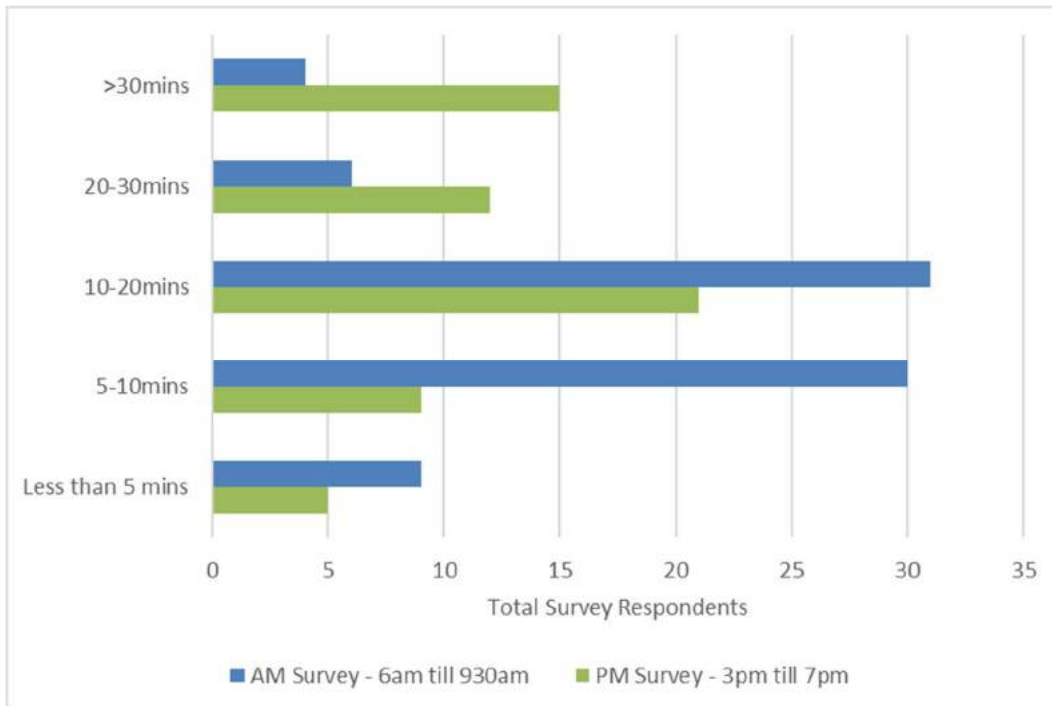
As shown the majority of commuters are travelling to Melbourne CBD during the morning survey period, with those travelling in the evening split between those outbound to Melbourne CBD and those returning commuters travelling home back to Lara.

Figure 12 Lara Station commuter travel purpose



As expected most commuters are travelling to work (66%) during the morning survey period, with 28% of respondents doing so for education purposes. In the evening peak period the majority are travelling for other reasons (52%), which is likely associated with more recreational purposes.

Figure 13 Lara Station commuter travel times



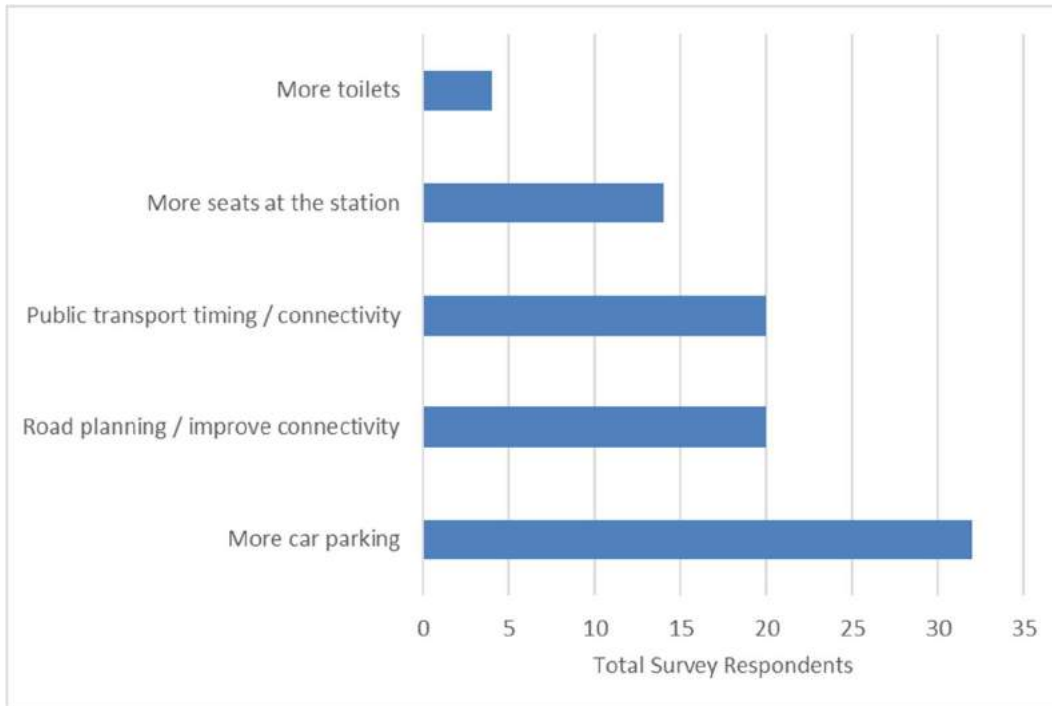
Commuters were asked how long their respective journeys took from their point of origin. 88% of respondents travelled less than 20 minutes to Lara Station during the morning survey period. Travel times increased during the evening peak period due to commuters travelling back from the Melbourne

CBD, with 44% of respondents stating a travel time of 20 minutes or more (24% stating more than 30 minutes).

1.2.5.5 Lara Station – suggested improvements

Lara Station commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 14 Lara Station – suggested improvements



The following can be noted from the above suggested improvements to either Lara Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following was noted:
 - 22% of respondents wanted more car parking at Lara Station
 - 14% of respondents would improve the road network planning and/or connectivity to Lara Station
 - 10% requested more seating at Lara Station
 - 3% requested more toilets at Lara Station
- In terms of 'soft' measures, the following was noted:
 - 14% of respondents requested better public transport timing and connectivity.

1.3 North Shore Station existing usage

1.3.1 Car parking

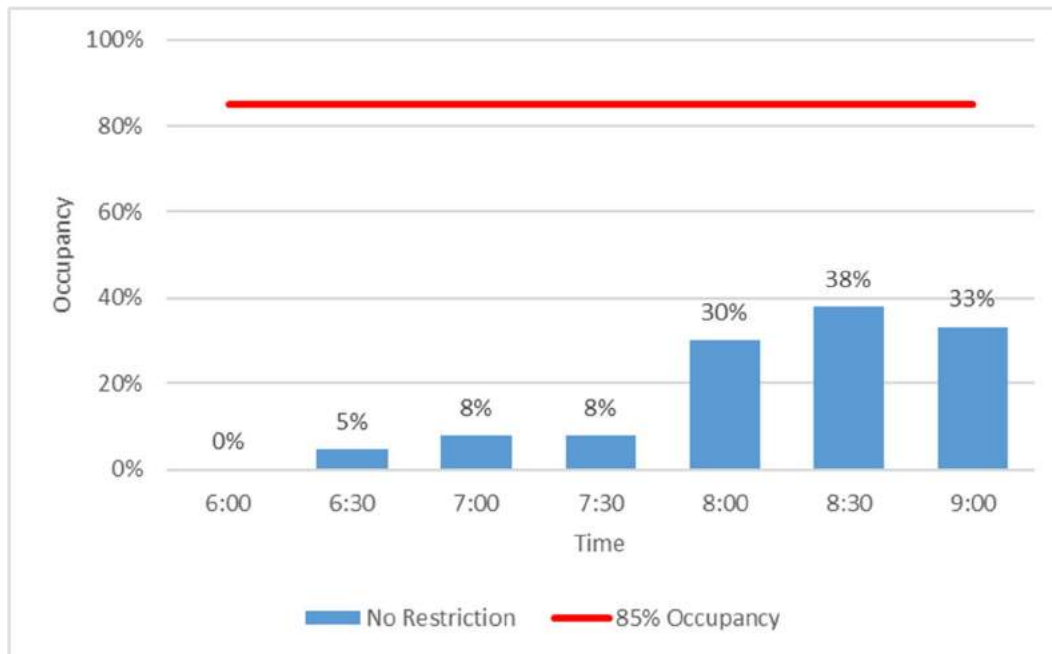
1.3.1.1 Off-street parking

A total of 65 off-street carparking spaces were recorded at North Shore Station. These consist of:

- 63 car parking spaces with no restrictions.
- Two disabled spaces.

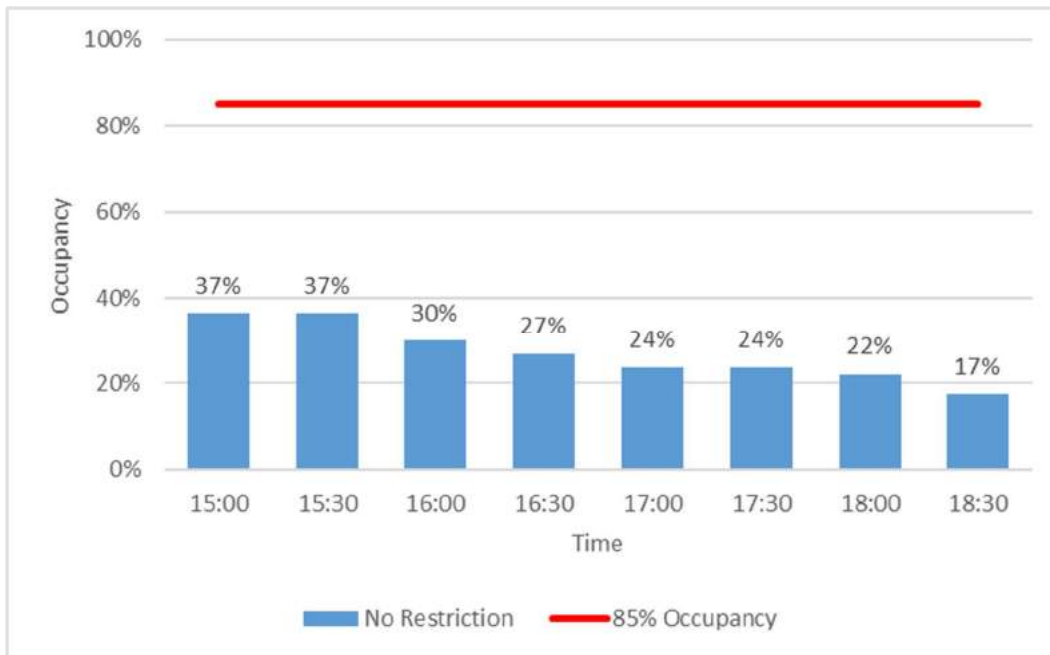
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 15 and Figure 16.

Figure 15 North Shore Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 16 North Shore Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

As shown from the North Shore Station car parking occupancy analysis there is spare car parking capacity in both the surveyed morning and evening periods.

Table 6 provides a summary of the supply and demand of parking spaces for the off-street carpark at North Shore Station.

Table 6 Overview of Supply and Demand of off-street carparking spaces at Lara Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	63	24	37%	8:30	5	8%	13:30
Disabled	2	0	0%	-	0	0%	-
Total formal car parking	65	24	37%	8:30	5	8%	13:30

1.3.1.2 On-street parking

No on-street car parking surveys were conducted near North Shore Station since following initial site observations spare parking capacity within the provided Station off-street car parking was observed therefore negating the need for any commuters to park on-street.

1.3.2 Car parking user observations

Survey observations indicated that all users of the North Shore Station off-street car park did so to use the Station.

1.3.3 Bicycle parking

North Shore Station has capacity for a total of 18 bicycles split between loops (10) and spirals (8).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 7 and Table 8.

Table 7 North Shore Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	10	0	0	0	0	0
	Spirals	8	0	0	0	0	0
	Total	18	0	0	0	0	0
	% Occupancy			0%	0%	0%	0%
Informal bicycle parking			0	0	0	0	0

Table 8 North Shore Station – Supply and demand bicycle parking, PM peak

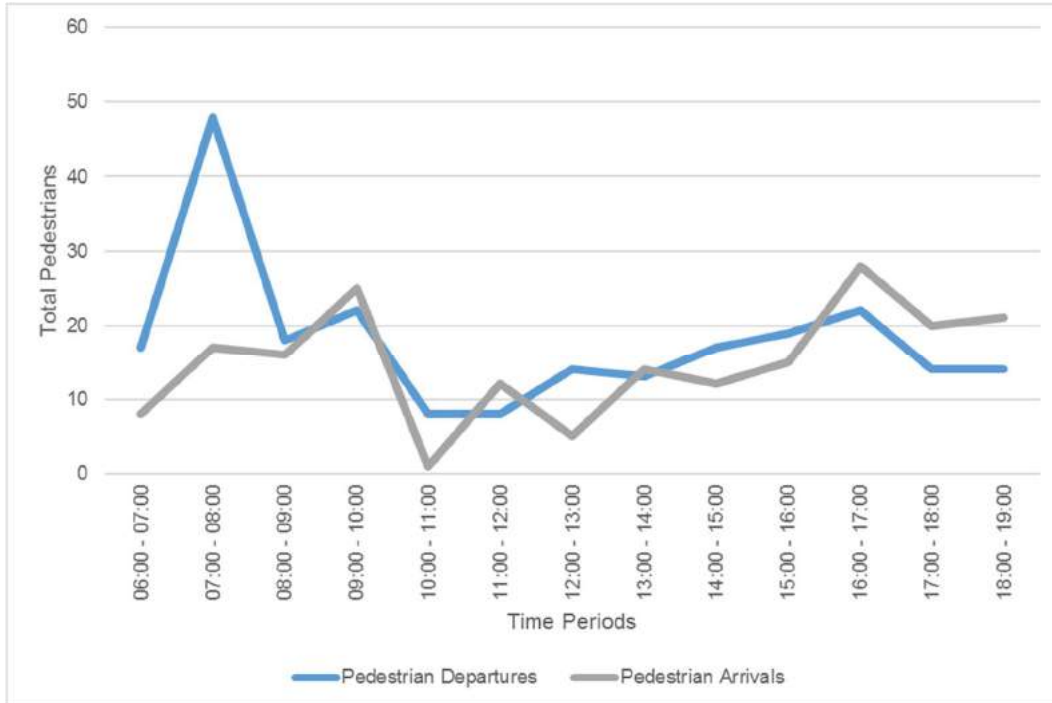
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	10	0	0	0	0	0
	Spirals	8	1	1	0	0	0
	Total	18	1	1	0	0	0
	% Occupancy			6%	6%	0%	0%
Informal bicycle parking			0	0	0	0	0

As shown above there is sufficient bicycle parking capacity at North Shore station to meet current demand.

1.3.4 Station gate volumes

The pedestrian arrivals and departures at North Shore Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours) at the pedestrian level crossing, which is the single access point to both platforms. The pedestrian flow profile over the surveyed period is shown in Figure 17.

Figure 17 North Shore Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 17:

- A total of 464 pedestrians travelled via North Shore Station over the total survey period.
- A total of 66 pedestrians (49 departing and 17 arriving) were recorded during the morning peak period between 7:00 and 8:00 departing from Lara Station.
- A total of 52 pedestrians (24 departing and 28 arriving) were recorded during the evening peak period between 16:00 and 17:00 arriving at Lara Station.

1.3.5 Questionnaire survey findings

The questionnaire surveys at North Shore Station received responses from 37 commuters in the AM period and 24 in the PM period.

1.3.5.1 Demographics

Survey respondents were:

- Primarily between the ages of 30-49 years old at 52%, the second largest age group were between 18-29 at 28%.
- 52% male and 48% females in both the morning and evening survey periods.
- Primarily full-time workers at 59% in the morning period and 54% in the evening period. Part-time workers being the second largest group with 22% in the morning period and 21% in the evening period.
- Primarily travelling for work purposes in the morning period at 73%, with 14% travelling for education purposes. In the evening peak period 50% of respondents were travelling for 'other' reasons and 46% for work purposes.

1.3.5.2 Mode share

The mode choice by the survey respondents on how they travelled to North Shore Station is shown in Figure 18. The reason of selection of this travel mode is shown in Figure 19 and Figure 20 for the morning and evening surveyed periods respectively.

Figure 18 North Shore Station – commuter modes

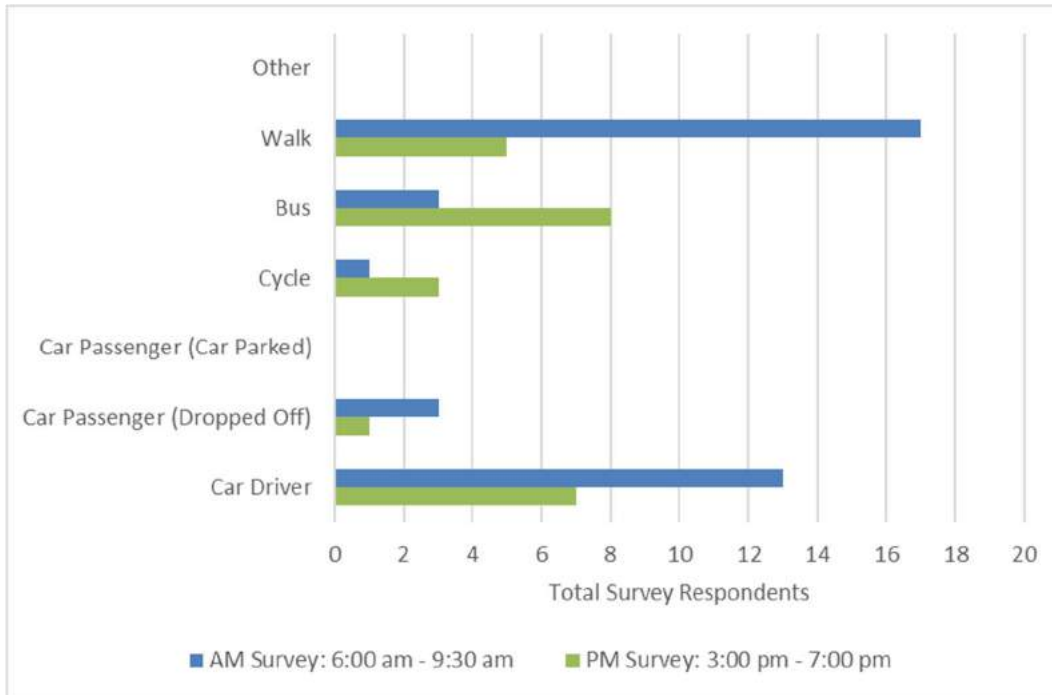


Figure 19 North Shore Station – commuter mode choice – morning peak

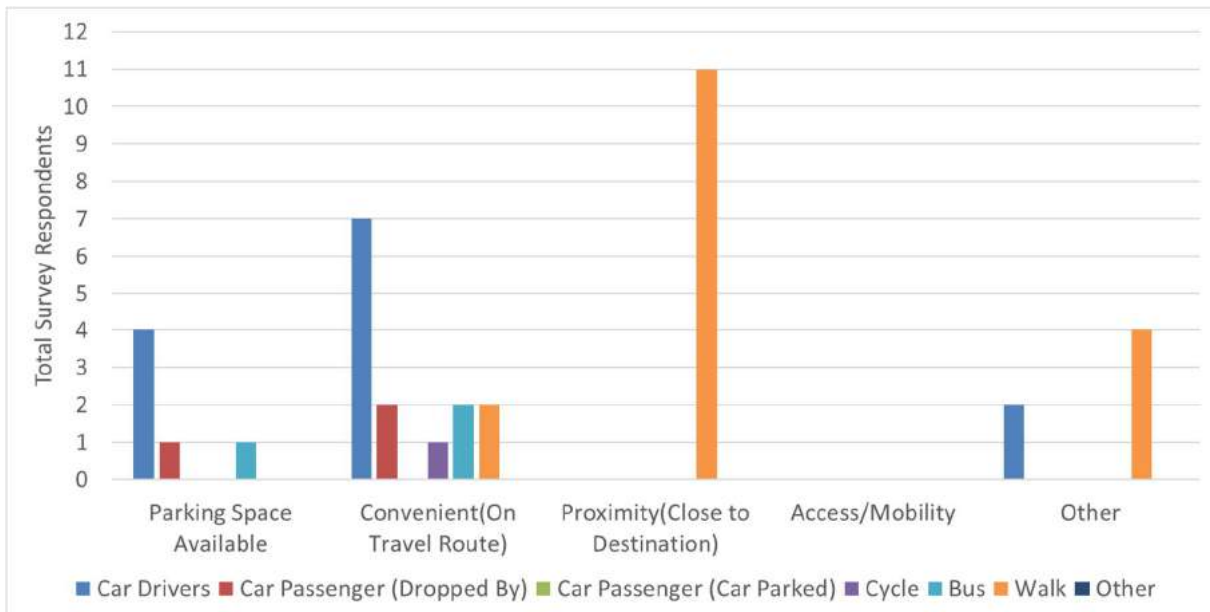
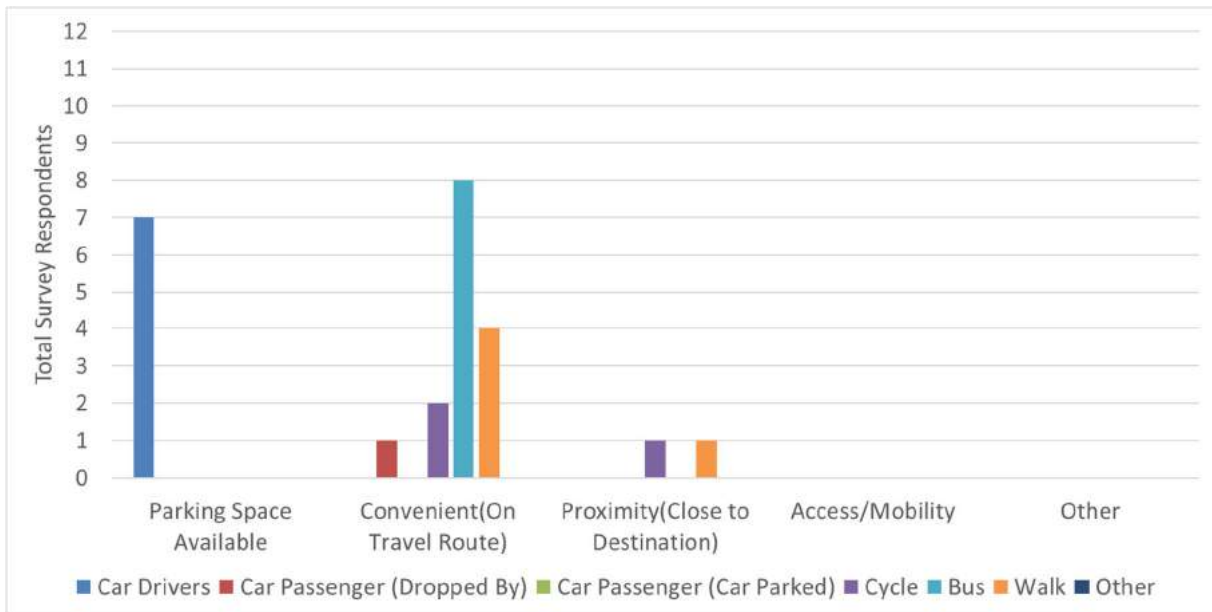


Figure 20 North Shore Station – commuter mode choice – evening peak



The following can be noted from the North Shore Station travel mode selection:

- 46% of commuter’s travel to North Shore Station on foot in the surveyed morning period with 43% by car (35% as driver and 8% car passenger drop-off). The main reasoning behind people walking to the station was its proximity to home.
- Only 33% of commuter’s travel to/from North Shore Station by car in the surveyed evening period, with commuters choosing to use the bus (33%), walk (21%) and bicycle (13%).

Main reason behind car usage was the availability of car parking spaces in the evening survey period, with bus usage and walking due to the convenient travel route to/from North Shore Station.

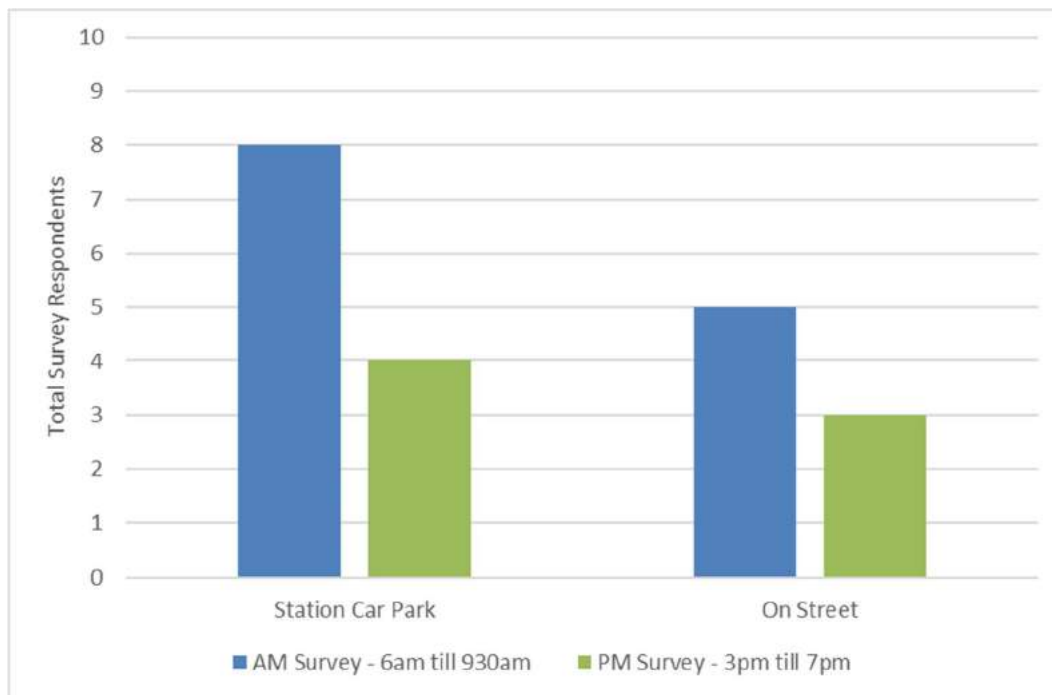
1.3.5.3 Commuter parking habits

The parking habits of commuters to North Shore Station is provided in Figure 21, the following is shown:

- Of the 13 car driver respondents in the morning survey period, eight parked in the station car park and five chose to park on-street
- Of the seven driver respondents in the evening survey period, four parking in the station car park and three chose to park on-street.

The reason behind drivers choosing to park on-street rather than using the station car park is unknown, since following the car parking occupancy surveys there are plenty of space car parking spaces to accommodate all of the surveyed car drivers (see Table 6).

Figure 21 North Shore Station – commuter parking location

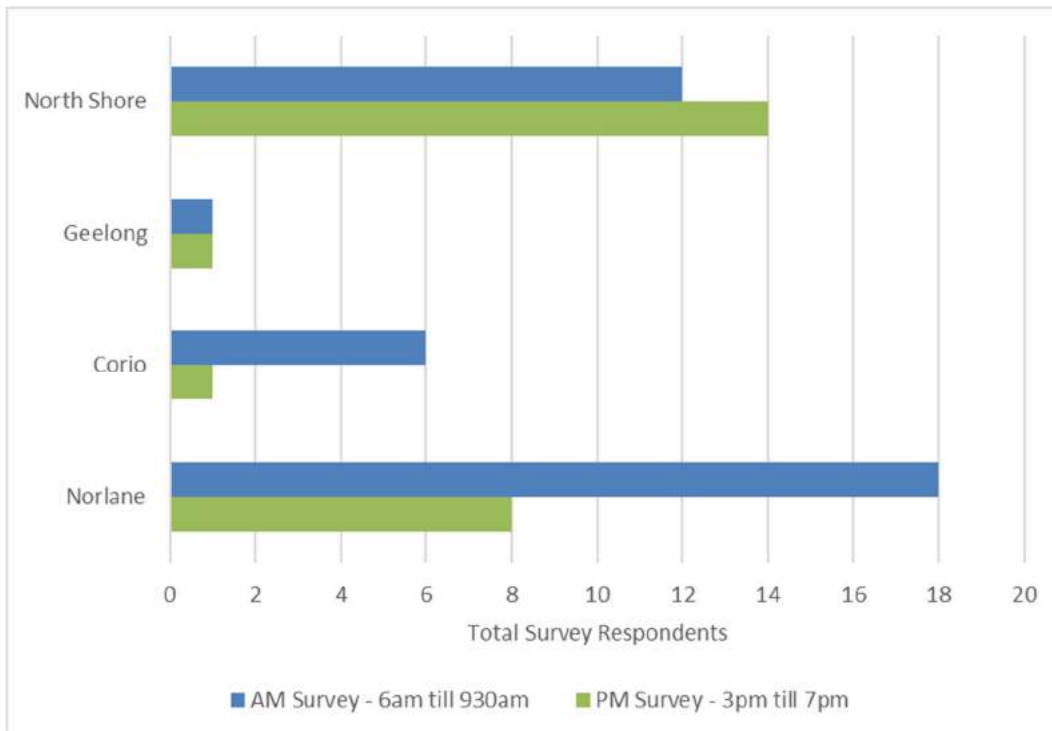


1.3.5.4 North Shore Station commuter travel findings

The following figures show the North Shore Station commuter travel origins/destination, travel purpose and times:

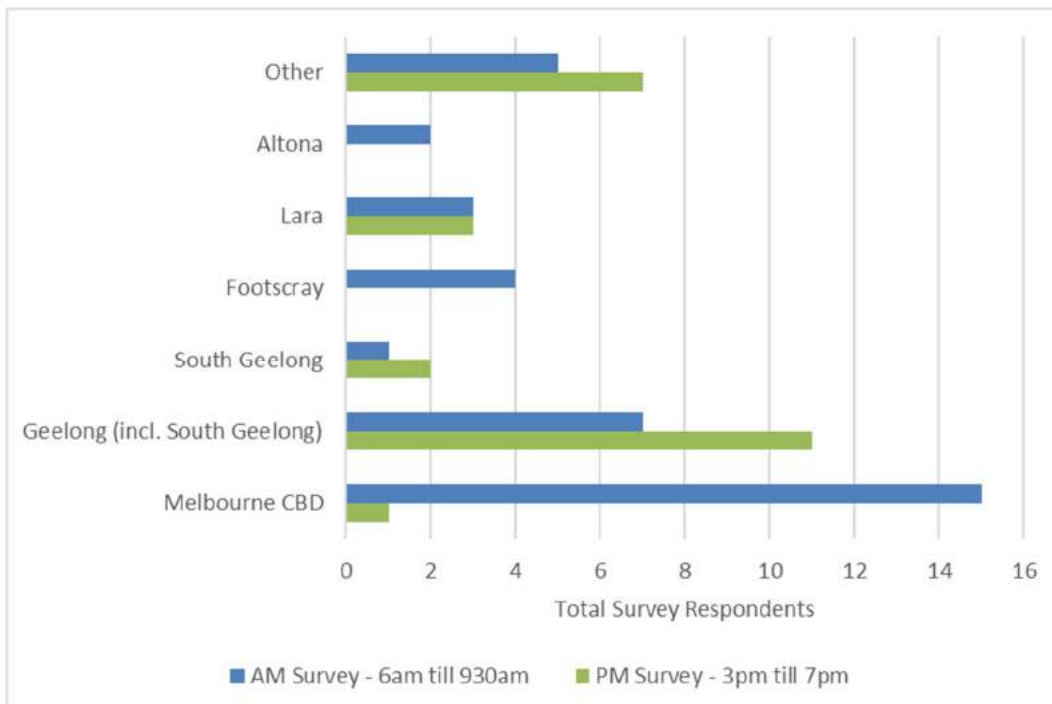
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 10 and Figure 11.
- The respondents travel purposes are surmised in Figure 12.
- The respondents indicative travel times are outlined in Figure 13.

Figure 22 North Shore Station commuter origins – AM and PM survey periods



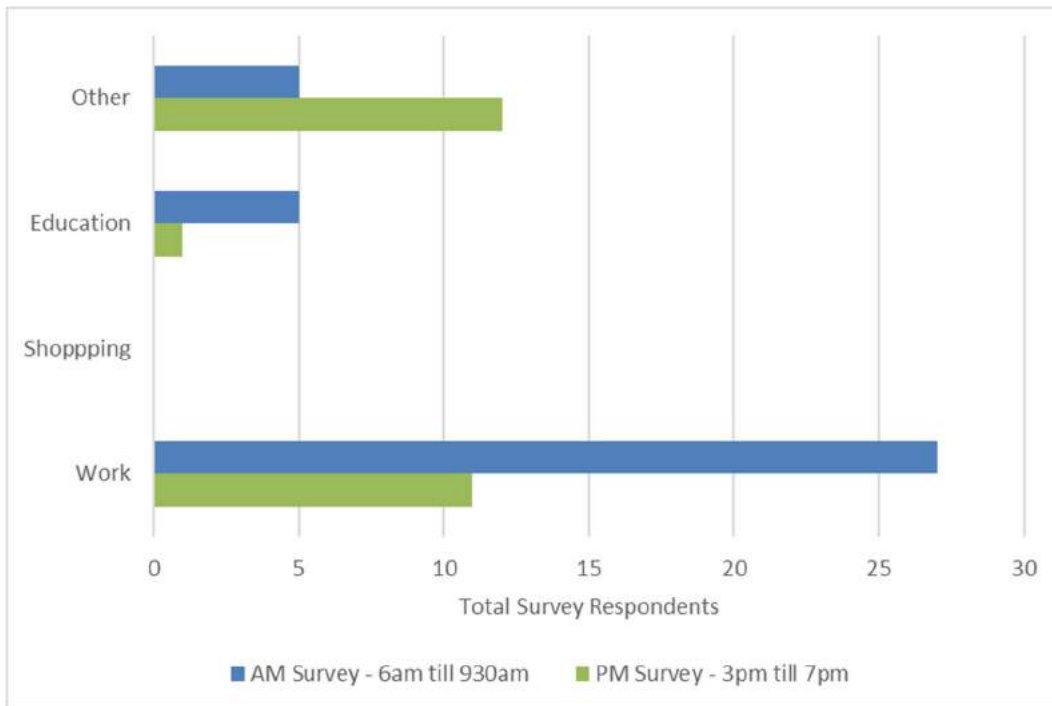
As shown the majority of commuters originate from Norlane and North Shore in both the morning and evening survey periods.

Figure 23 North Shore Station commuter destinations – AM and PM survey periods



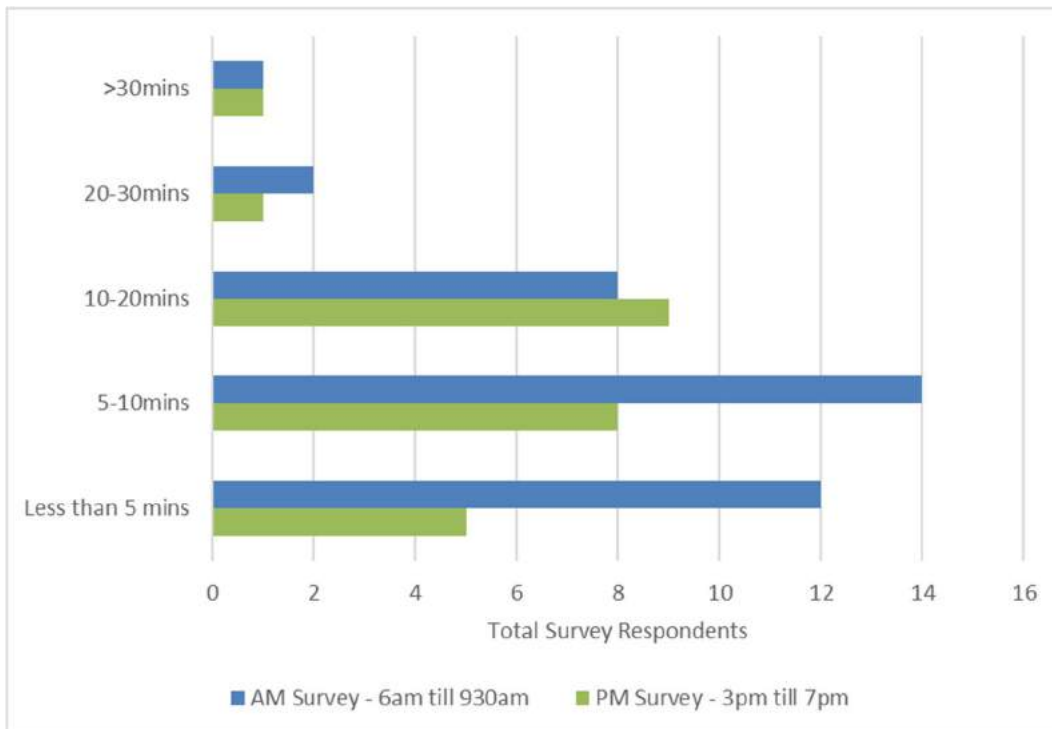
As shown the majority of commuters are travelling to Melbourne CBD during the morning survey period, with those travelling in the evening from Geelong.

Figure 24 North Shore Station commuter travel purpose



As expected most commuters are travelling to work (73%) during the morning survey period, with 14% of respondents doing so for education purposes. In the evening peak period the commuters are split travelling between other reasons (50%) and work (46%).

Figure 25 North Shore Station commuter travel times

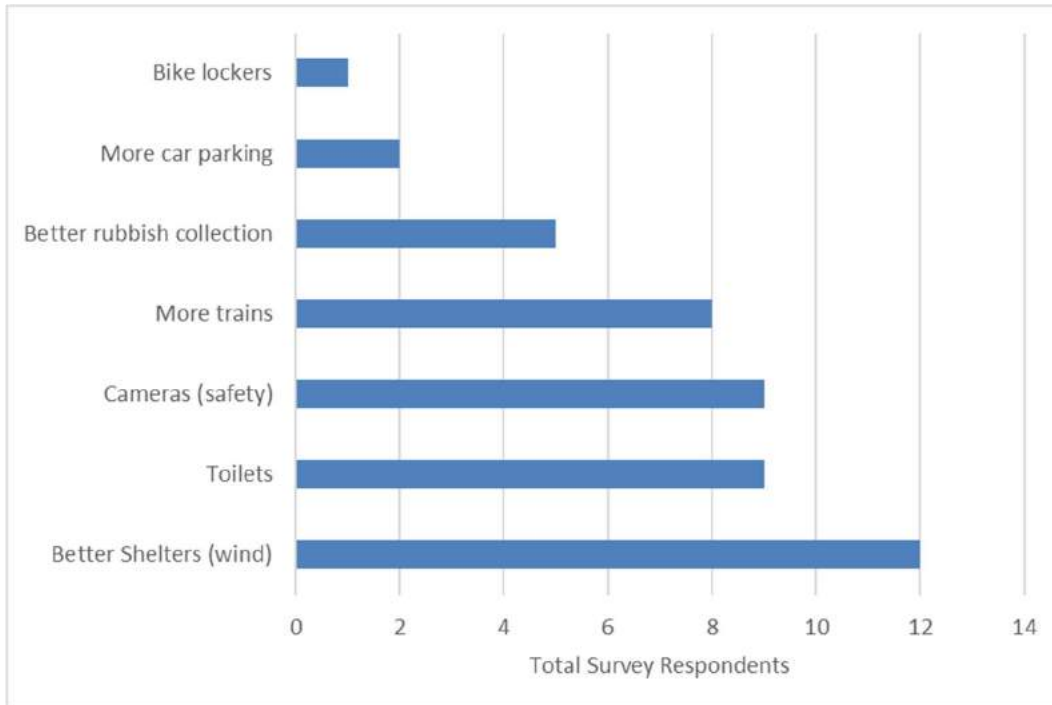


Commuters were asked how long their respective journeys took from their point of origin. 92% of respondents travelled less than 20 minutes to North Shore Station during both of the morning and evening survey periods.

1.3.5.5 North Shore Station – suggested improvements

North Shore Station commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 26 North Shore Station suggested improvements



The following can be noted from the above suggested improvements to either North Shore Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of ‘hard’ measures, the following was noted:
 - 19% of respondents requested better shelter at the station.
 - 14% requested more/better toilets.
 - 14% requested more cameras to improve the safety of the station.
 - 3% requested more car parking.
 - 2% requested bicycle lockers.
- In terms of ‘soft’ measures, the following was noted:
 - 13% of respondents requested for more trains to be provided from the station.

1.4 North Geelong Station existing usage

1.4.1 Car parking

1.4.1.1 Off-street parking

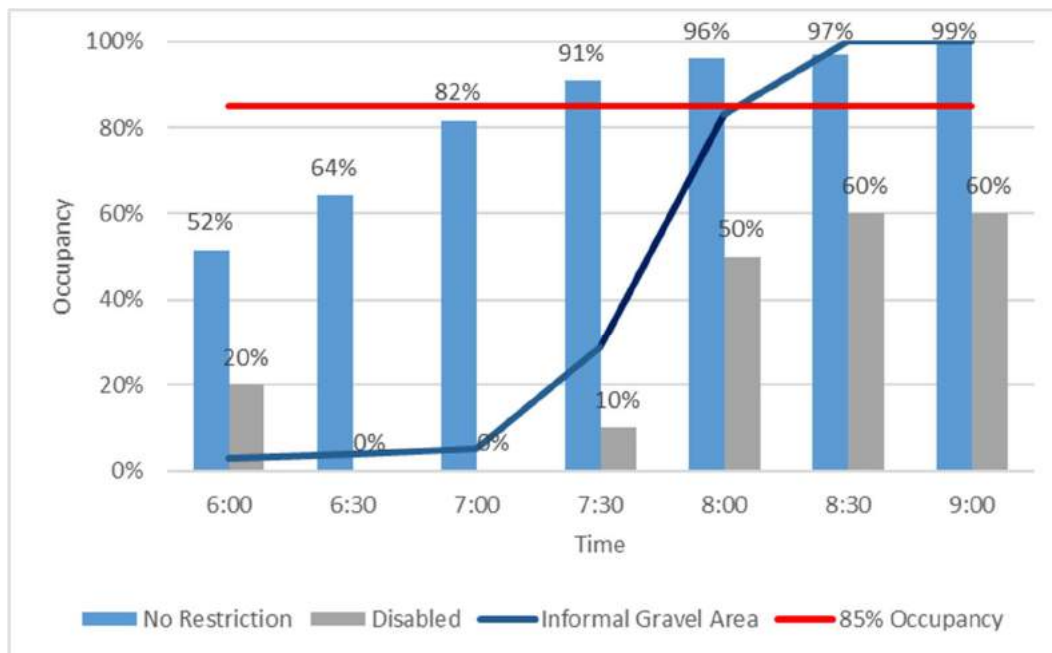
A total of 466 off-street carparking spaces were recorded at North Geelong Station. These consist of:

- 444 car parking spaces with no restrictions.
- Seven '15-minute' kiss and ride spaces.
- Three '5-minute' kiss and ride spaces
- 10 disabled spaces

In addition, it was observed that the gravel area to the north of the main off-street car park is used informally by commuters. The parking capacity in this area was observed on site to cater for 100 cars.

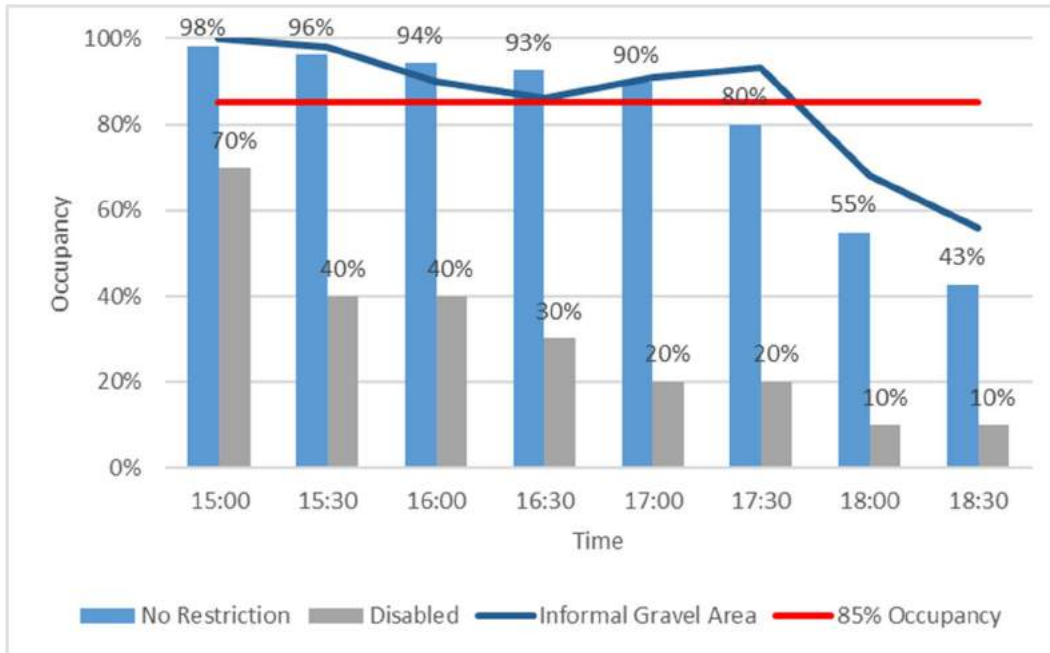
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 27 and Figure 28.

Figure 27 North Geelong Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 28 North Geelong Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 27 and Figure 28:

- 99% (440 of the 444 parking spaces occupied, with only 4 spaces available) of formal parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey. With the informal gravel parking area being utilised at 100%.
- By the commencement of the evening peak occupancy survey 98% of available formal parking spaces were occupied, with only 8 spaces available. The informal gravel parking area was operating at 100%.
- Disabled parking provision was at most 70% (7 of the 10) of spaces occupied at 3:00 pm.

Table 9 provides a summary of the supply and demand of parking spaces for the off-street carpark at North Geelong Station.

Table 9 Overview of Supply and Demand of off-street carparking spaces at North Geelong Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	444	440	99%	09:00	188	42%	14:00
Disabled	10	7	70%	15:00	2	20%	13:00 – 14:00
P5 minutes	3	1	33%	08:30 to 09:00 and 15:00	0	-	-
P15 minutes	7	5	71%	15:00	3	43%	13:30
Total formal car parking	464	450	97%	09:00	191	41%	14:00
Informal gravel car parking area	100	100	100%	8:30 to 9:00 and 15:00	1	1%	All time periods
Total car parking	564	550	98%	09:00	192	34%	14:00

It can be noted from Table 9 that the formal carpark at North Geelong Station was surveyed to be operating at a maximum of 97%, with the informal gravel parking area being at 100%.

1.4.1.2 On-street parking

Not surveyed since initial site observations indicated no on-street car parking. However, survey responses had a sample of people who parked on-street.

1.4.2 Car parking user observations

Surveys showed that all users of the North Geelong Station off-street car park did so to use the station.

1.4.3 Bicycle parking

North Geelong Station has capacity for a total of 34 bicycles split between loops (26) and lockers (8).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 10 and Table 11.

Table 10 North Geelong Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	26	0	4	5	5	5
	Lockers	8	0	0	0	0	0
	Total	34	0	4	5	5	5
	% Occupancy			0%	12%	15%	15%
Informal bicycle parking			0	0	0	0	0

Table 11 North Geelong Station – Supply and demand bicycle parking, PM peak

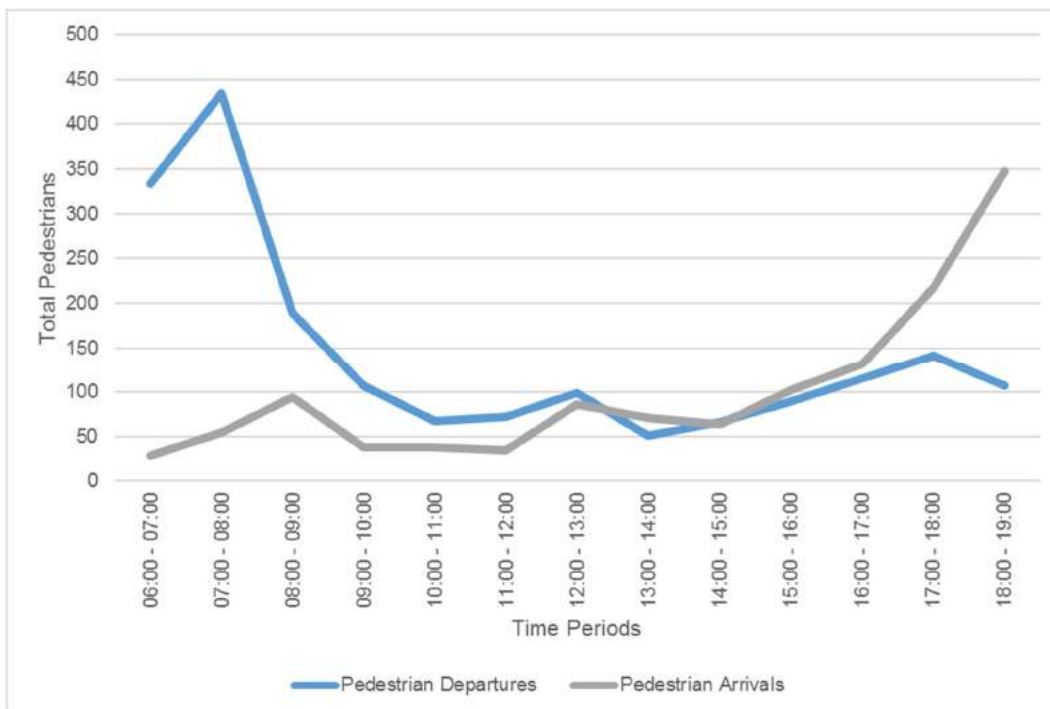
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	26	5	5	5	4	1
	Lockers	8	0	0	0	0	0
	Total	34	5	5	5	4	1
	% Occupancy			15%	15%	15%	12%
Informal bicycle parking			1	1	1	1	0

As shown from Table 10 and Table 11 there is sufficient bicycle parking capacity at North Geelong station to cater to current cycling demand, with a peak bicycle parking occupancy of 15 percent.

1.4.4 Station gate volumes

The pedestrian arrivals and departures at North Geelong Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours). The pedestrian flow profile over the surveyed period is shown in Figure 29.

Figure 29 North Geelong Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 29:

- A total of 3,179 pedestrians travelled via North Geelong Station over the total survey period.
- A total of 488 pedestrians (434 departing and 54 arriving) were recorded during the morning peak period between 7:00 and 8:00 departing from North Geelong Station.
- A total of 455 pedestrians (107 departing and 348 arriving) were recorded during the evening peak period between 18:00 and 19:00 arriving at North Geelong Station.

1.4.5 Questionnaire survey findings

The questionnaire surveys at North Geelong Station received responses from 172 commuters in the AM period and 113 in the PM period.

1.4.5.1 Demographics

Survey respondents were:

- Primarily split between the ages of 18-29 years old at 39% and 30-49 years old at 37%.
- 59% male and 41% females across the survey periods.
- Primarily full-time workers at 56% in the morning period and 43% in the evening period.
- Primarily travelling for work purposes in the morning period at 73%, with 17% travelling for education purposes. In the evening peak period 46% of respondents were travelling to work, 35% for 'other' reasons and 17% for education purposes.

1.4.5.2 Mode share

The mode choice by the survey respondents on how they travelled to North Geelong Station is shown in Figure 30. The reason of selection of this travel mode is shown in Figure 31 and Figure 32 for the morning and evening surveyed periods respectively.

Figure 30 North Geelong Station – commuter modes

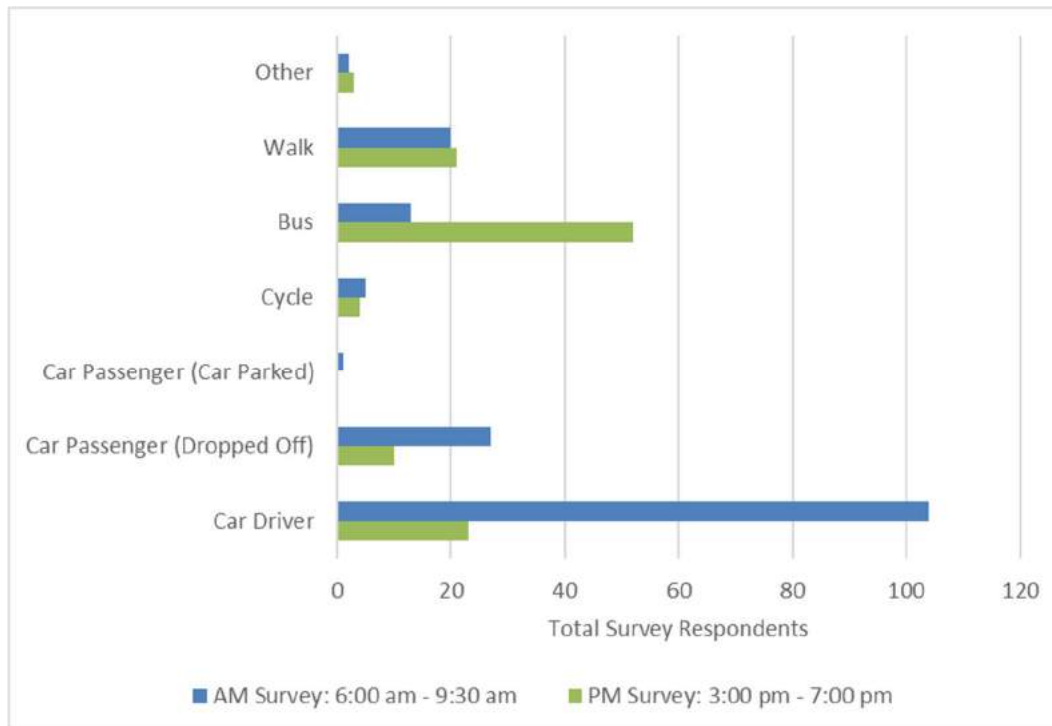


Figure 31 North Geelong – commuter mode choice – morning peak

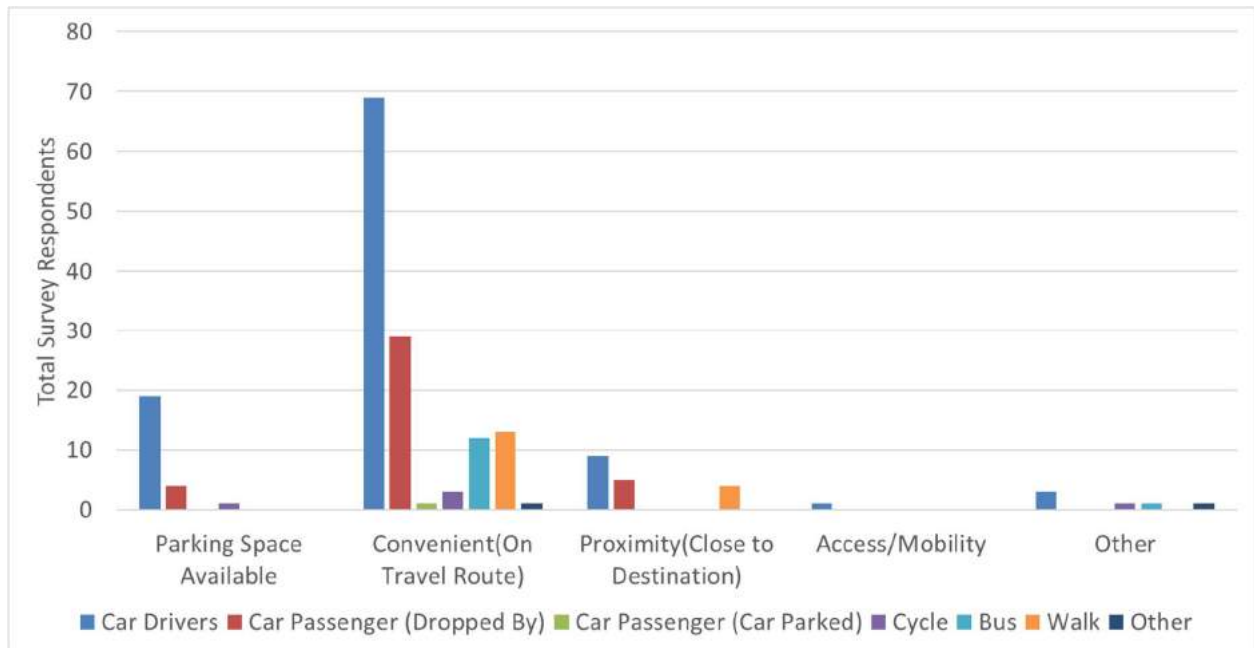
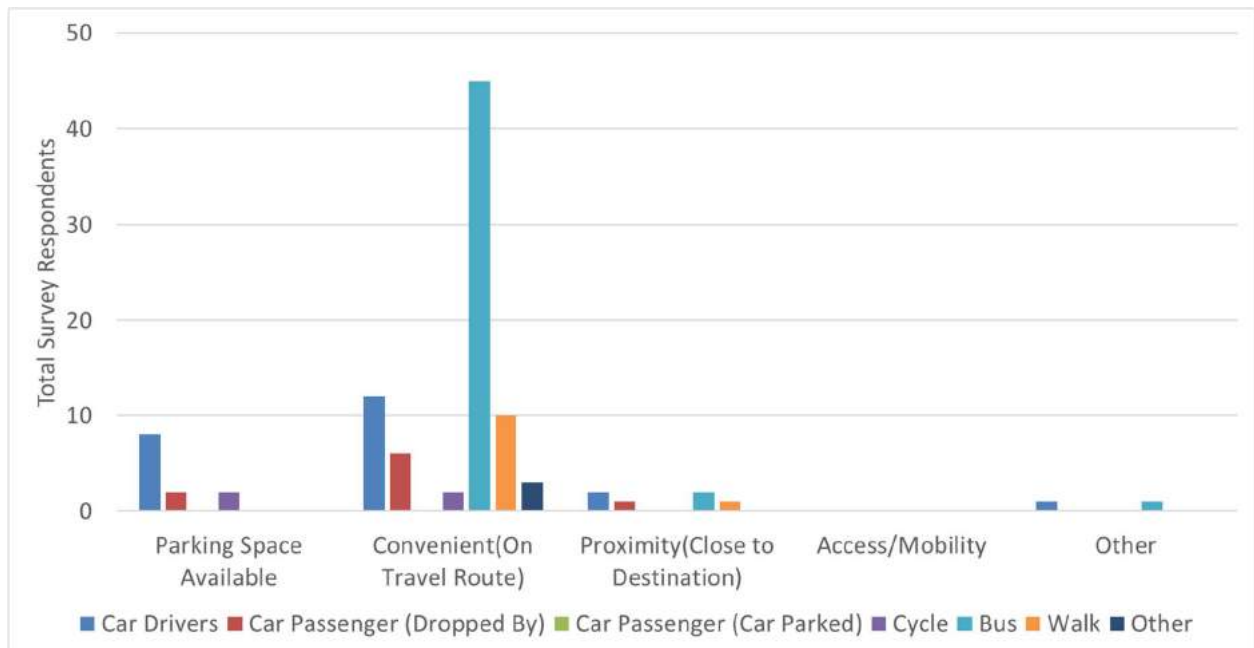


Figure 32 North Geelong – commuter mode choice – evening peak



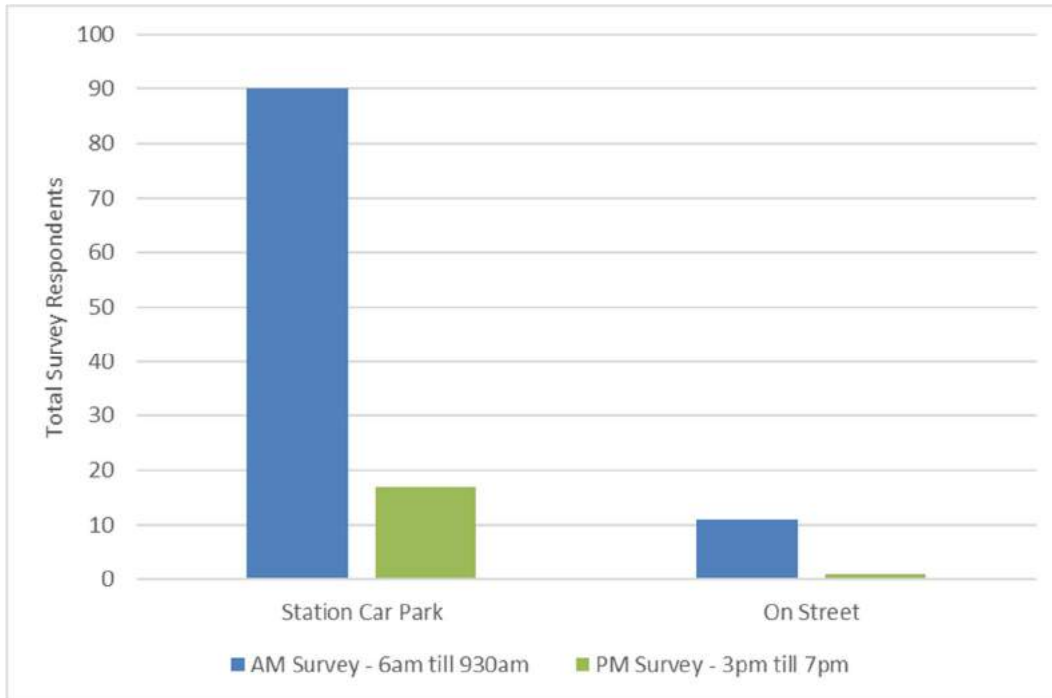
The following can be noted from the North Geelong Station travel mode selection:

- 77% of commuter’s travel to Lara Station by car in the surveyed morning period with 60% being car driver, 16% being dropped off and 1% being a car passenger which parked at the station. 12% of respondents walked to the station and 8% used the bus. The main reasoning behind car use was the convenience of the station on their travel route.
- Only 29% of commuter’s travel to/from North Geelong Station by car in the surveyed evening period, with a higher proportion of commuters choosing to travel by bus (46%) or walk (19%). Main reason behind people choosing to walk was the convenience of the station on their travel route.

1.4.5.3 Commuter parking habits

The parking habits of commuters to North Geelong Station is provided in Figure 35. As shown the majority parked in the off-street station car park.

Figure 33 North Geelong Station – commuter parking location

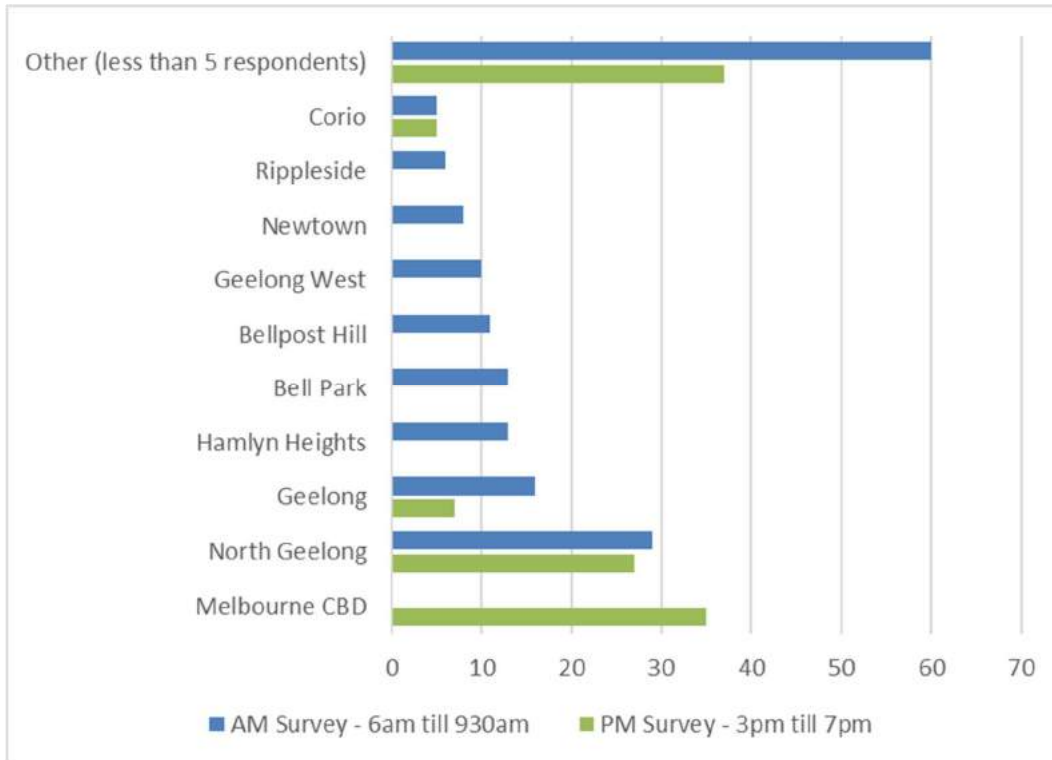


1.4.5.4 North Geelong Station commuter travel findings

The following figures show the North Geelong Station commuter travel origins/destination, travel purpose and times:

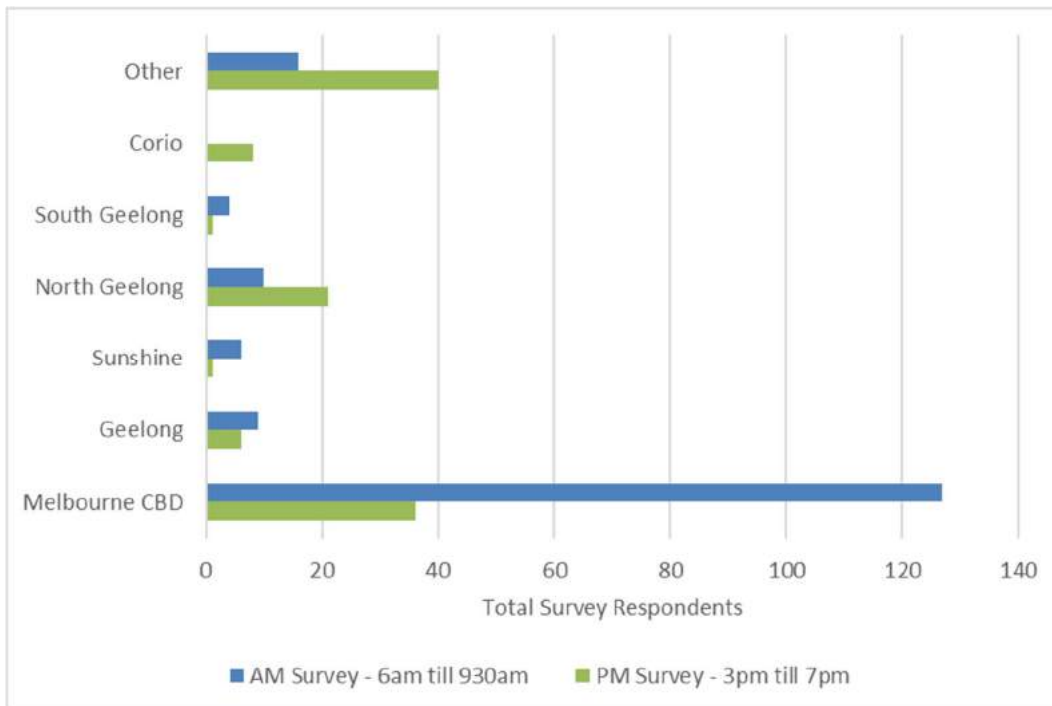
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 10 and Figure 11.
- The respondents travel purposes are surmised in Figure 12.
- The respondents indicative travel times are outlined in Figure 13.

Figure 34 North Geelong commuter origins – AM and PM survey periods



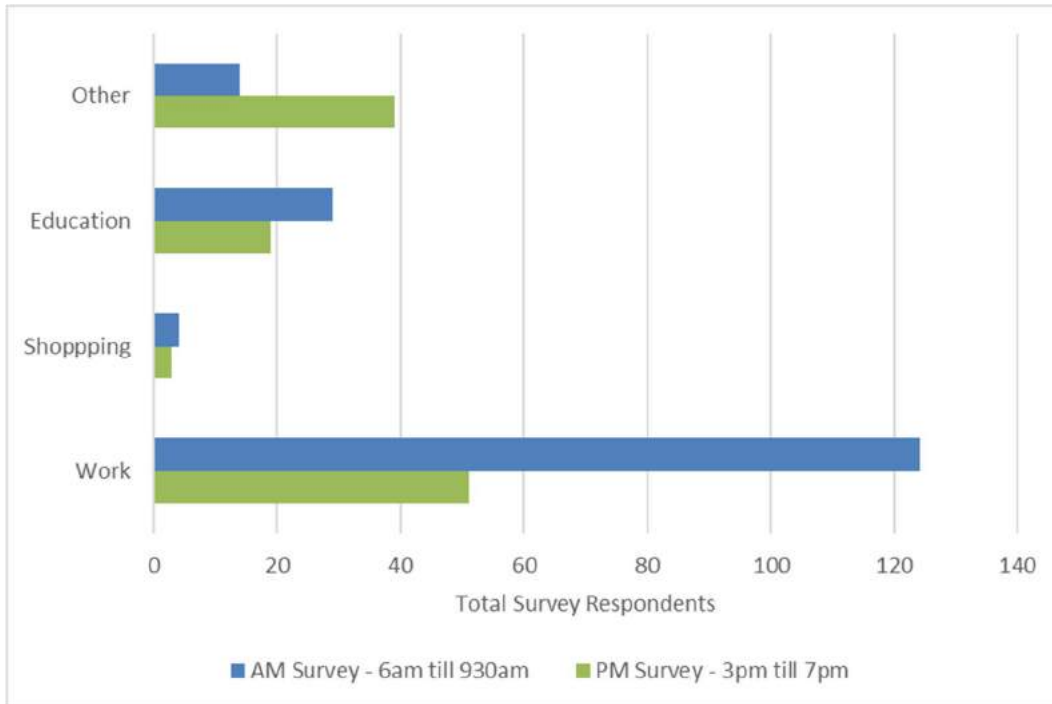
As shown there was a wide range of responses with regards to commuter’s origins during the morning survey period, with most commuters originating from North Geelong (17%). Responses were split between from Melbourne CBD (32%) and North Geelong (24%) in the evening.

Figure 35 North Geelong commuter destinations – AM and PM survey periods



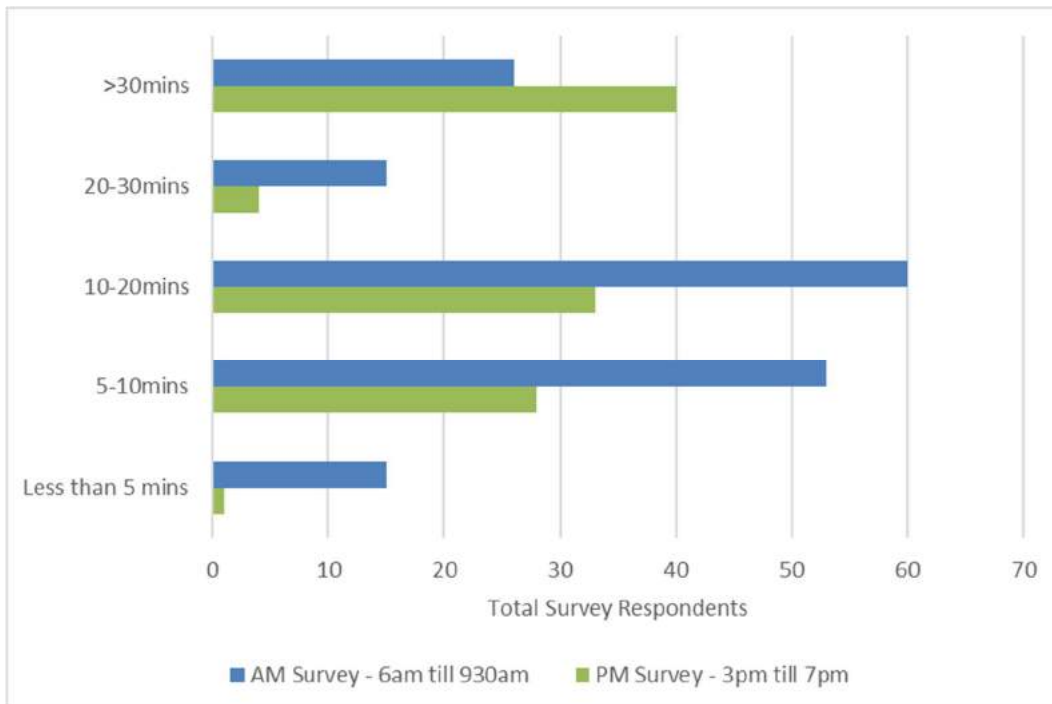
As shown the majority of commuters are travelling to Melbourne CBD during the morning survey period, with those travelling in the evening split between those outbound to Melbourne CBD and those returning commuters travelling home back to North Geelong and other local areas.

Figure 36 North Geelong Station commuter travel purpose



Most commuters are travelling to work (73%) during the morning survey period, with 17% of respondents doing so for education purposes. In the evening peak period the commuters are travelling for work (46%), other (35%) and education (17%) purposes.

Figure 37 North Geelong Station commuter travel times

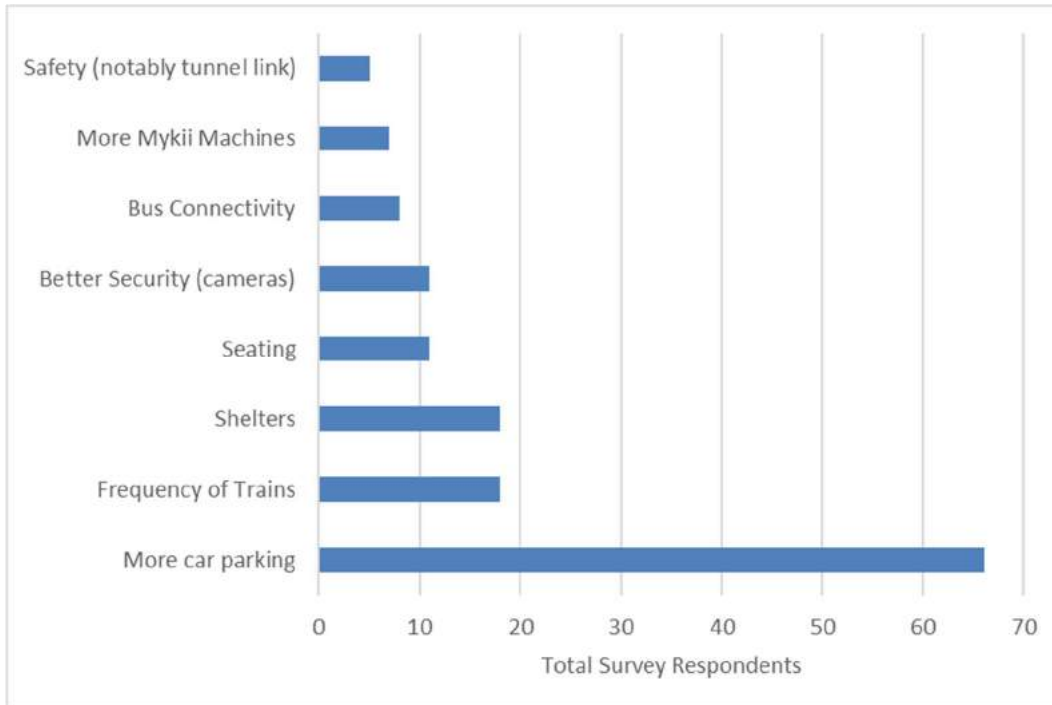


Commuters were asked how long their respective journeys took from their point of origin 76% of respondents travelled less than 20 minutes to North Geelong Station during the morning survey period. Travel times increased during the evening peak period due to commuters travelling back from the Melbourne CBD, with 38% of respondents stating a travel time of 30 minutes or more. 58% of respondents travelled less than 20 minutes in the evening survey period.

1.4.5.5 North Geelong Station – suggested improvements

North Geelong commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 38 North Geelong Station – suggested improvements



The following can be noted from the above suggested improvements to either North Geelong Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following was noted:
 - 45% of respondents wanted more car parking at North Geelong Station
 - 12% requested shelters at the station.
 - A total of 11% requested better security, split between cameras (8%) and the tunnel link (3%)
 - 8% requested more seating.
 - 5% suggested more myki machines at the station.
- In terms of 'soft' measures, the following was noted:
 - 12% of respondents requested more frequent trains from the station.
 - 5% requested better connectivity with local buses.

1.5 Geelong Station existing usage

1.5.1 Car parking

1.5.1.1 Off-street parking

A total of 642 off-street carparking spaces were recorded at Geelong Station. These consisted of:

- At the eastern car park (totalling 97 car parking spaces):
 - 44 V/Line customer only parking spaces.
 - 21 Unrestricted parking spaces.
 - 12 Kiss and Ride parking spaces, includes seven 2P and five 10P spaces.
 - Nine motorcycle parking spaces.
 - Six taxi parking spaces.
 - Four disabled parking spaces.
 - Two kiosk staff permit parking spaces.
 - A single no stopping parking space which is authorised for V/Line parking only.
- At the western car park a total of 443 unrestricted parking spaces are provided.

Car parking occupancy surveys were undertaken on two days at Geelong Station, as the initial survey did not accurately record the parking provision, occupancy or informal parking activities (noting that the discrepancies with regards to provision and occupancy were only attributed to the car parking spaces in the eastern car park, therefore this data has still been analysed to understand unrestricted commuter car parking demands.

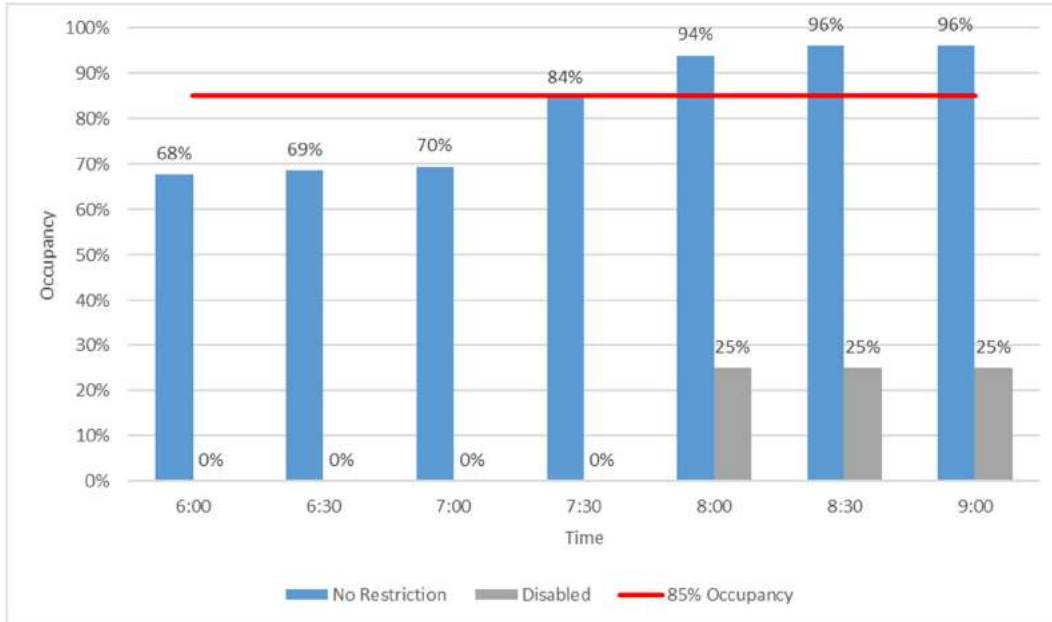
Due to the parking demands at Geelong Station patrons have been observed to park informally within the car park itself, even on verges, undesignated areas or completely blocking other vehicles.

The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 39 and Figure 40.

The occupancy survey results of the off-street carpark on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 41 and Figure 42.

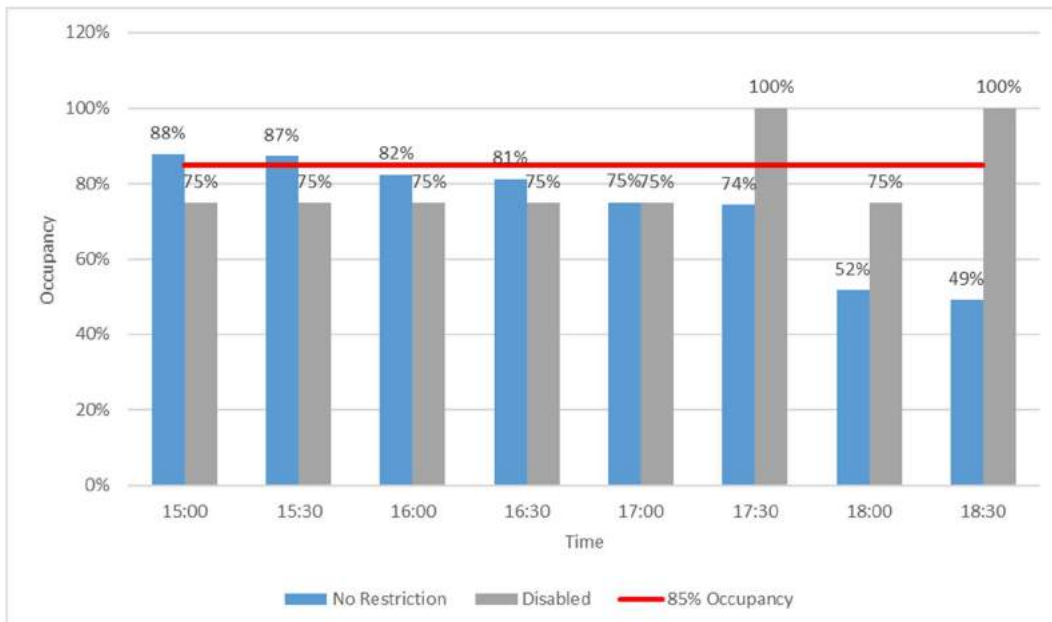
It is noted that on the Tuesday 5th June 2018 parking survey that some works were occurring locally which meant formal parking provision in the western car park was reduced from 443 to 361 parking spaces. However, informal parking was surveyed and showed that the surplus could find parking in the car park up to a total of 65 cars. Comparing the unrestricted parking demand totals between the two survey days showed similar peak parking demands (i.e. 426 on Tuesday 27th March 2018 and 444 on Tuesday 5th June 2018).

Figure 39 Geelong Station off-street car parking occupancy – Tues 24 March 2018 - morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 40 Geelong Station off-street car parking occupancy – Tues 24 March 2018 – evening peak period (3:00pm to 7:00pm)

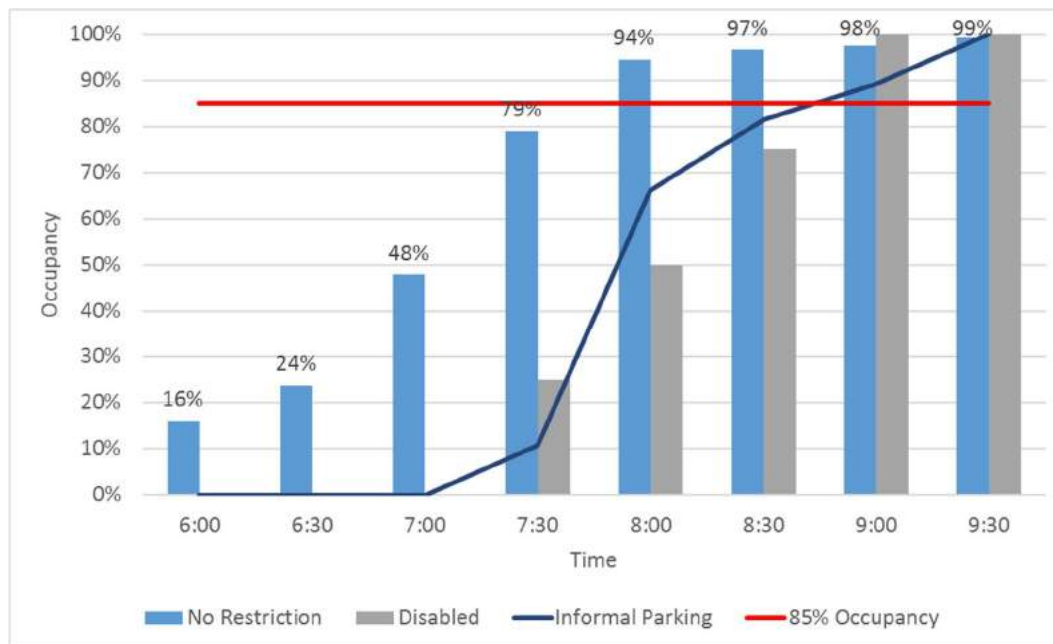


Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 39 and Figure 40.

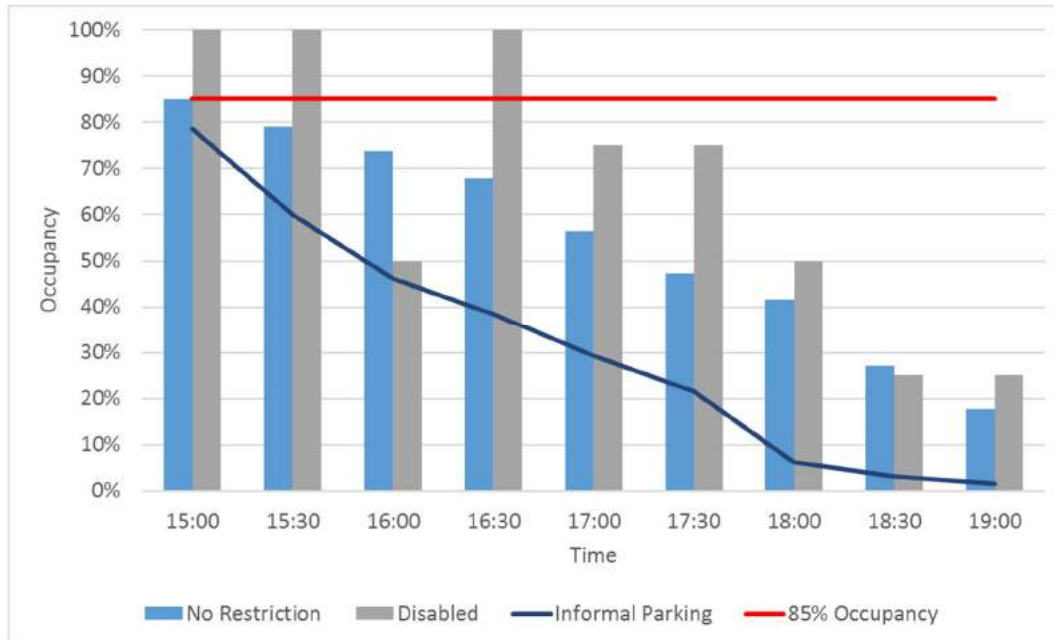
- 96% (426 of the 443 no restriction car parking spaces occupied, with only 17 spaces available) of parking spaces were occupied from 8:30 am in the morning.
- By the commencement of the evening peak occupancy survey 88% of the no restriction parking spaces were occupied, with 54 car parking spaces available.
- There was ample disabled parking provision during the morning period. At the commencement of the evening occupancy survey 75% of spaces were occupied (3 of 4 spaces), with all spaces occupied at 17:30 and 18:30 survey time periods.

Figure 41 Geelong Station off-street car parking occupancy – Tues 5 June 2018 - morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 42 Geelong Station off-street car parking occupancy – Tues 5 June 2018 - morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 41 and Figure 42:

- 99% of no restriction parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey.
- By the commencement of the evening peak occupancy survey 85% of available parking spaces were occupied.
- Disabled parking provision was fully utilised by the end of the morning survey period, with spaces only available at 16:00 and from 17:00 onwards during the evening survey period.

Table 12 overleaf provides a summary of the supply and demand of parking spaces for the off-street carpark at Geelong Station.

It can be noted that the no restriction commuter car parking at Geelong Station is over capacity, with two independent survey days showing occupancy of 96% and 100% respectively. This consequently results in informal parking at the station.

Table 12 Overview of Supply and Demand of off-street carparking spaces at Geelong Station

Car Park Location	Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018			Tuesday 5 th June 2018		
			Demand	Occupancy	Peak Demand	Demand	Occupancy	Peak Demand	Demand	Occupancy	Peak Demand
Eastern Car Park	No Restriction	21	Not surveyed			Not surveyed			19	90%	15:00
	Permit Zone A	8	7	88%	09:00, 15:00, 16:00	2	25%	11:30 – 14:30	8	100%	7:00 – 9:30, 15:00, 16:00
	Permit Zone B	92	45	50%	15:00	25	27%	13:00 - 14:30	92	100%	9:30
	P2min	7	5	71%	17:00 – 17:30, 18:30	4	57%	10:30, 11:30, 13:00	6	86%	16:30
	P10min	5	5	100%	15:30, 16:30, 17:30	4	80%	11:00	5	100%	9:00 – 9:30, 15:30, 16:30
	P Kiosk Staff	2	Not surveyed			Not surveyed			2	100%	7:00 – 9:30, 15:00 - 17:30
	No Stopping – except V/Line	1	1	100%	6:00 – 9:00, 15:00 – 18:30	1	100%	10:30 – 14:30	1	100%	6:00 – 9:30, 15:00 – 16:00, 16:30 – 19:00
	Taxi Zone	6	6	100%	17:30	4	67%	11:00	5	83%	16:30
	Motorcycles only	9	2	22%	15:00 – 16:30	0	0%	-	2	22%	15:00 – 16:30
	V/Line customers only	44	40	91%	07:30 – 09:00	40	91%	12:00 – 12:30	43	98%	6:00 – 7:30, 09:00
	Disabled	4	4	100%	17:30, 18:30	1	25%	10:30, 12:30	4	100%	9:00 – 9:30, 15:00 - 15:30, 16:30
Informal	5	Not surveyed			Not surveyed			5	100%	8:00	
Western Car Park	No Restriction	443 (361*)	426	96%	08:30 – 9:00	89	20%	13:30	361	100%	08:00 – 9:30
	Informal	65*	Not surveyed			Not surveyed			65	100%	9:30
Total car parking (excluding informal)		642 (560*)	530	83%	09:00	163	25%	13:00	540*	96%	9:30

*Note 443 no restriction parking supply during normal conditions. Survey on Tuesday 5th June 2018 had 361 spaces available due to works, however informal parking demand increased which offset loss of parking when compared to normal conditions. During normal conditions informal parking is also observed to occur.

1.5.2 Car parking user observations

Car parking user observations were undertaken during the parking surveys to understand those patrons whom are parking at Geelong Station but not using the station.

The survey results from Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are outlined in Table 13 and Table 14.

Table 13 Geelong Station – Non-commuter parking observations, AM peak

Car Park	Morning surveys – total non-commuter cars parked						
	6:00	6:30	7:00	7:30	8:00	8:30	9:00
Eastern Car Park (CP1)	14	15	15	16	14	9	10
Western Car Park (CP2)	0	0	9	10	11	8	12

The peak parking demands at the eastern and western Geelong car parks was surveyed to be 179 and 426 cars respectively during the morning survey period. As shown above, a total of 93 (52% of total demand) and 50 (12% of total demand) patrons who parked in the Geelong eastern and western car parks respectively did not use the station.

Table 14 Geelong Station – Non-commuter parking observations, PM peak

Car Park	Morning surveys – total non-commuter cars parked							
	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30
Eastern Car Park (CP1)	19	18	18	13	12	13	9	7
Western Car Park (CP2)	30	29	29	12	11	10	6	3

The peak parking demands at the eastern and western Geelong car parks was surveyed to be 161 and 389 cars respectively during the evening survey period. As shown above, a total of 109 (68% of total demand) and 130 (33% of total demand) patrons who parked in the Geelong eastern and western car parks respectively did not use the station. This survey time period gives a more informative insight into parking habits at Geelong Station when compared to the morning survey period, as a number of cars were already parked prior to survey commencement in the morning (300 cars at 6am).

1.5.3 Bicycle parking

Geelong Station has capacity for a total of 62 bicycles split between loops (30), spirals (14), lockers (4) and a parkiteer cage (provides capacity for 12 loops and 14 hanging bikes).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 15 and Table 16.

Table 15 Geelong Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys					
			6:00	7:00	8:00	9:00	9:30	
Formal bicycle parking	Loops	18	2	3	4	4	4	
	Spirals	14	4	5	8	8	9	
	Lockers	4	0	0	0	0	0	
	Parkiteer Cage	Loops	12	1	4	5	5	5
		Hanging	14	1	3	3	3	3
	Total		62	8	15	20	20	21
% Occupancy			13%	27%	32%	32%	34%	

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Informal bicycle parking			0	0	0	0	0

Table 16 Geelong Station – Supply and demand bicycle parking, PM peak

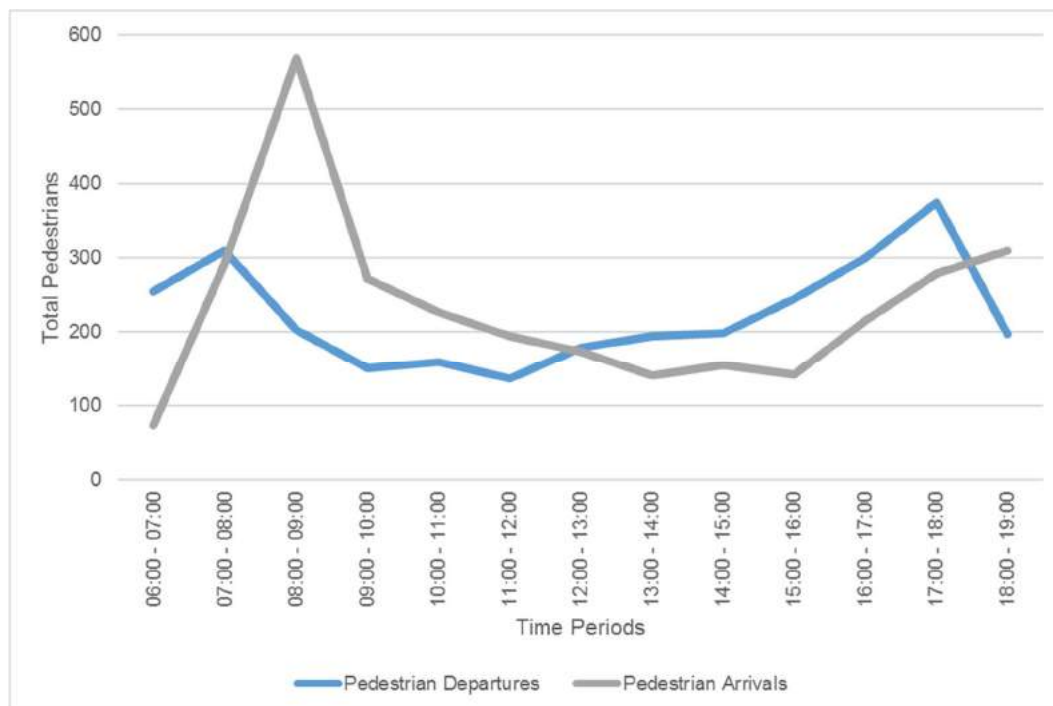
Bicycle parking		Supply	Evening surveys					
			15:00	16:00	17:00	18:00	19:00	
Formal bicycle parking	Loops	18	4	3	2	1	0	
	Spirals	14	10	9	6	6	5	
	Lockers	4	0	0	0	0	0	
	Parkiteer Cage	Loops	12	5	6	6	4	1
		Hanging	14	3	3	3	2	2
	Total		62	22	21	15	13	8
% Occupancy			35%	34%	27%	21%	13%	
Informal bicycle parking			0	0	0	0	0	

As shown from Table 15 and Table 16, there is sufficient bicycle parking capacity at Geelong Station to cater to existing demand, with a peak bicycle parking occupancy of 35 percent.

1.5.4 Station gate volumes

The pedestrian arrivals and departures at Geelong Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours). The pedestrian flow profile over the surveyed period is shown in Figure 43 .

Figure 43 Geelong Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 43:

- A total of 5,937 pedestrians travelled via Geelong Station over the total survey period.
- A total of 770 pedestrians (202 departing and 568 arriving) were recorded during the morning peak period between 8:00 and 9:00.
- A total of 653 pedestrians (374 departing and 279 arriving) were recorded during the evening peak period between 17:00 and 18:00.

1.5.5 Questionnaire survey findings

The questionnaire surveys at Geelong Station received responses from 164 commuters in the AM period and 156 in the PM period.

1.5.5.1 Demographics

Survey respondents were:

- Split between the ages of 30-49 years old at 41% and 18-29 years old at 37%.
- 43% male and 57% females across the survey periods.
- Primarily full-time workers at 51% in the morning period and 48% in the evening period. Students made up 18% and 23% of the respondents in morning and evening survey periods respectively.
- Primarily travelling for work purposes in the morning period at 49%, with 32% travelling for other reasons and 18% for education. In the evening peak period 47% of respondents were travelling for work 25% education and 23% for other reasons.

1.5.5.2 Mode share

The mode choice by the survey respondents on how they travelled to Geelong Station is shown in Figure 44. The reason of selection of this travel mode is shown in Figure 45 and Figure 46 for the morning and evening surveyed periods respectively.

Figure 44 Geelong Station – commuter modes

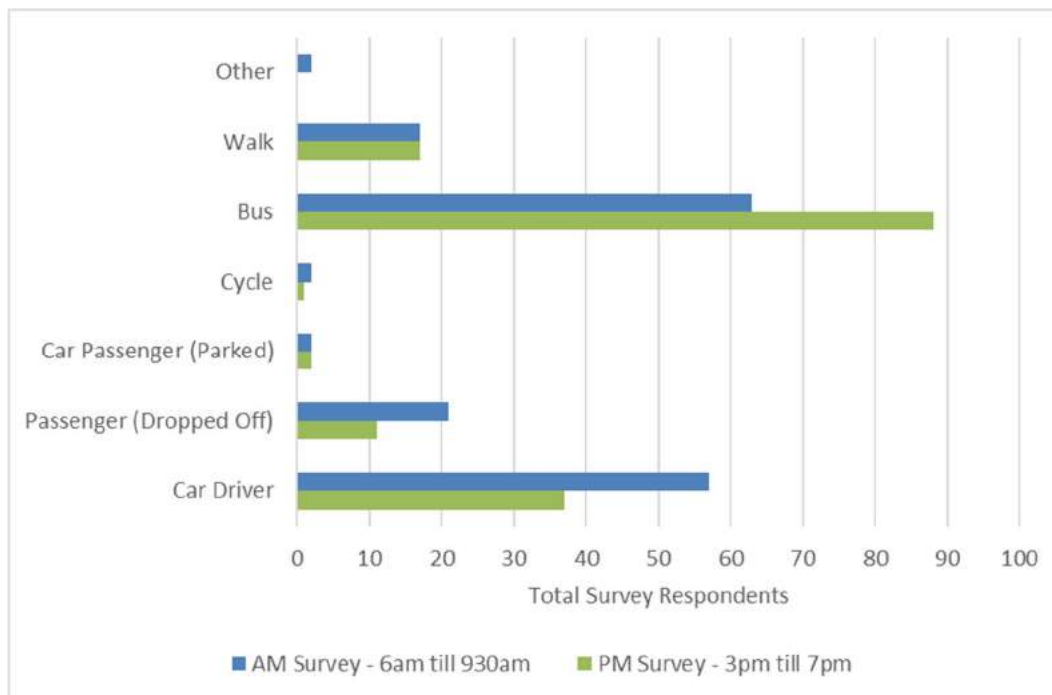


Figure 45 Geelong Station – commuter mode choice – morning peak

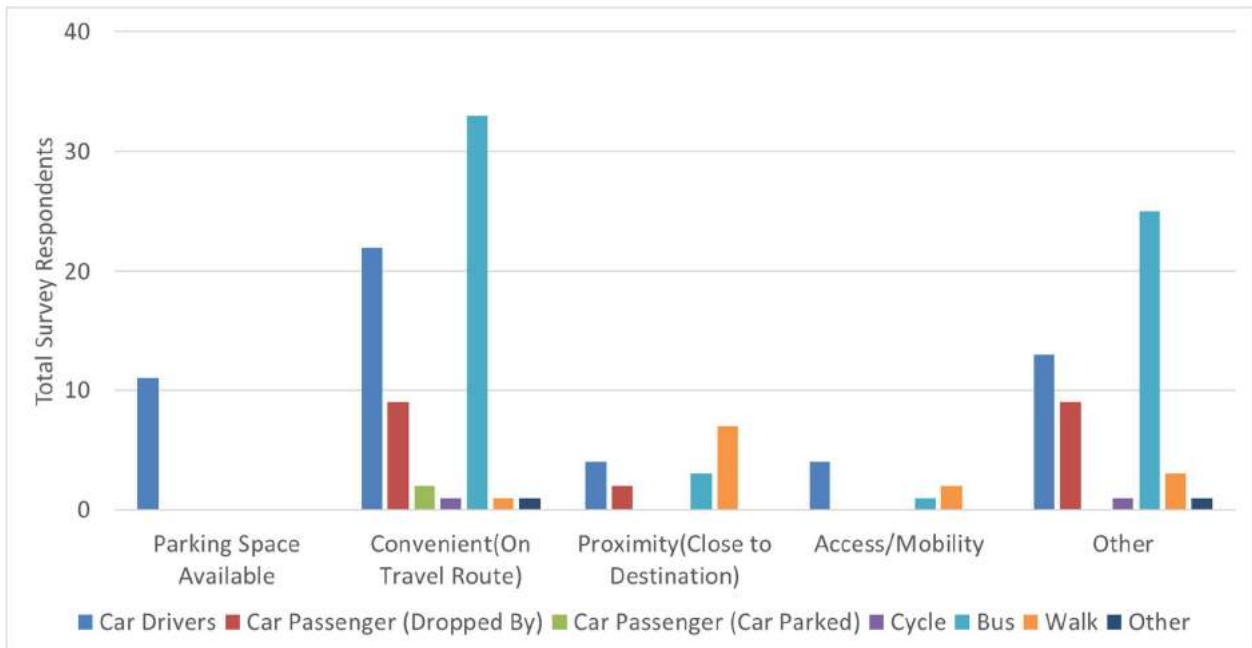
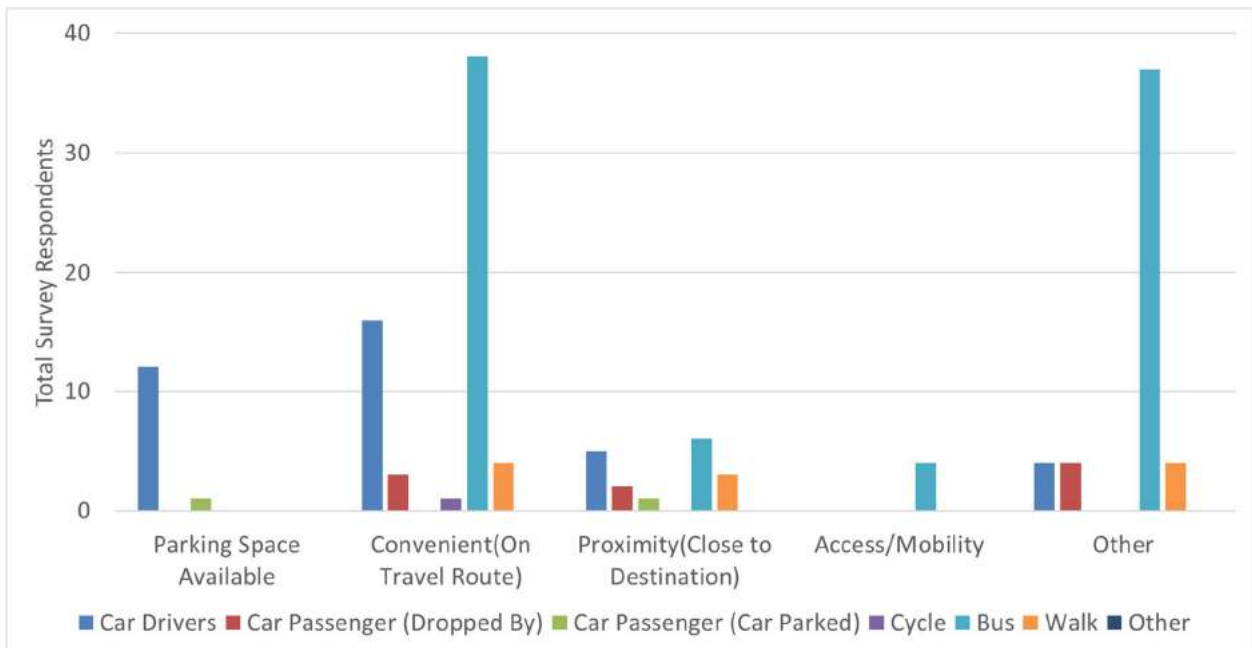


Figure 46 Geelong Station – commuter mode choice – evening peak



The following can be noted from the Geelong Station travel mode selection:

- 49% of commuter’s travel to Geelong Station by car in the surveyed morning period with 35% being car driver, 13% being dropped off and 1% as car passenger. 38% of commuters used the bus in the morning period and 10% walked.

The main reasoning behind by car and bus usage was the convenience of the station on the persons travel route. With walking mainly due to the proximity of the station.

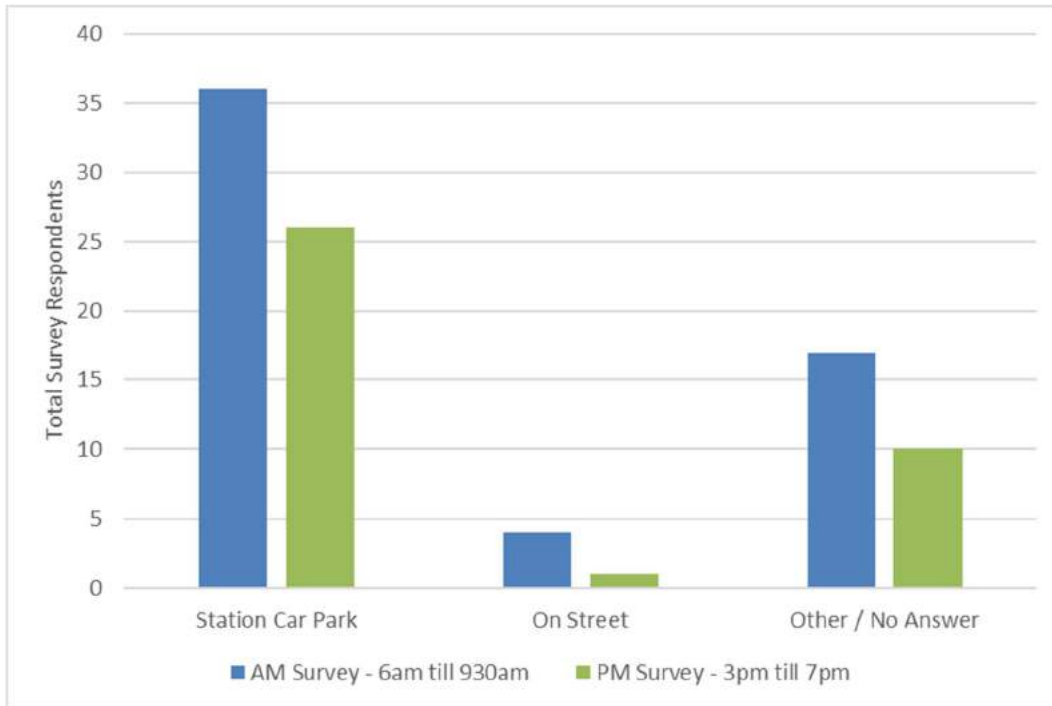
- Only 31% of commuter’s travel to/from Geelong Station by car in the surveyed evening period (24% as driver and 7% being picked up), with commuters travelling choosing to travel by bus (56%) or walk (11%).

Main reason behind car usage was the availability of car parking spaces and station being on the persons travel route. Commuters also primarily used the bus due to it being on their travel route to/from the station.

1.5.5.3 Commuter parking habits

The parking habits of commuters to Geelong Station is provided in Figure 9. As shown the majority parked in the off-street station car park (93% of total respondents to this question).

Figure 47 Geelong Station – Commuter parking location

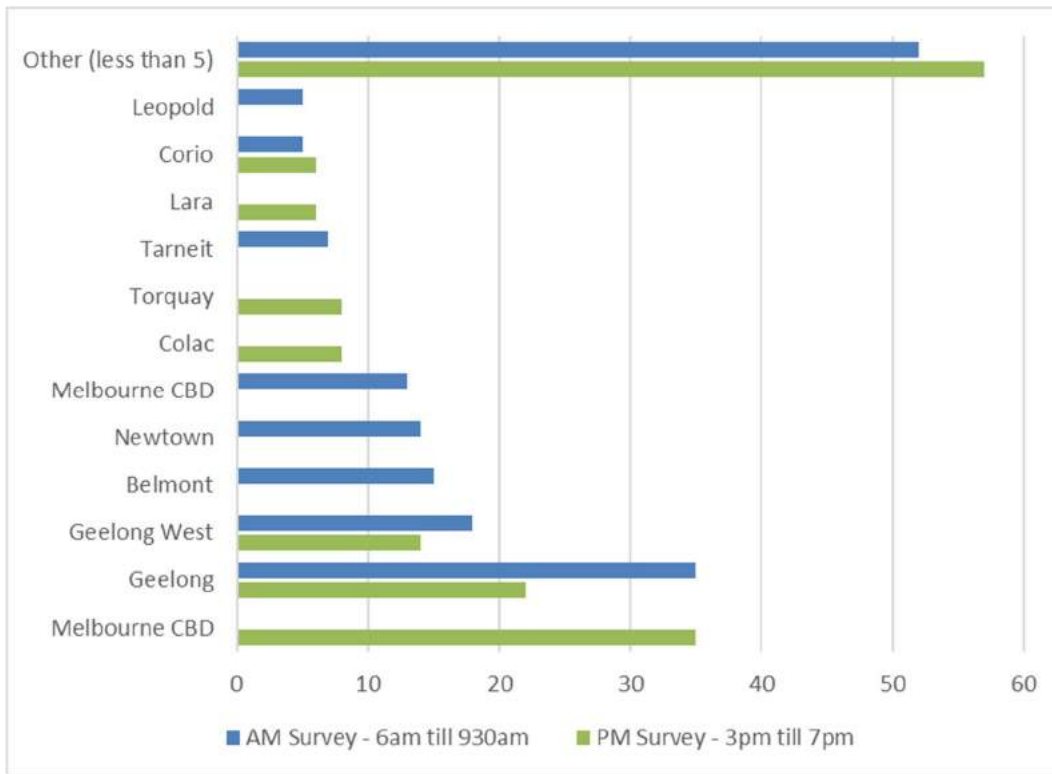


1.5.5.4 Geelong Station commuter travel findings

The following figures show the Geelong Station commuter travel origins/destination, travel purpose and times:

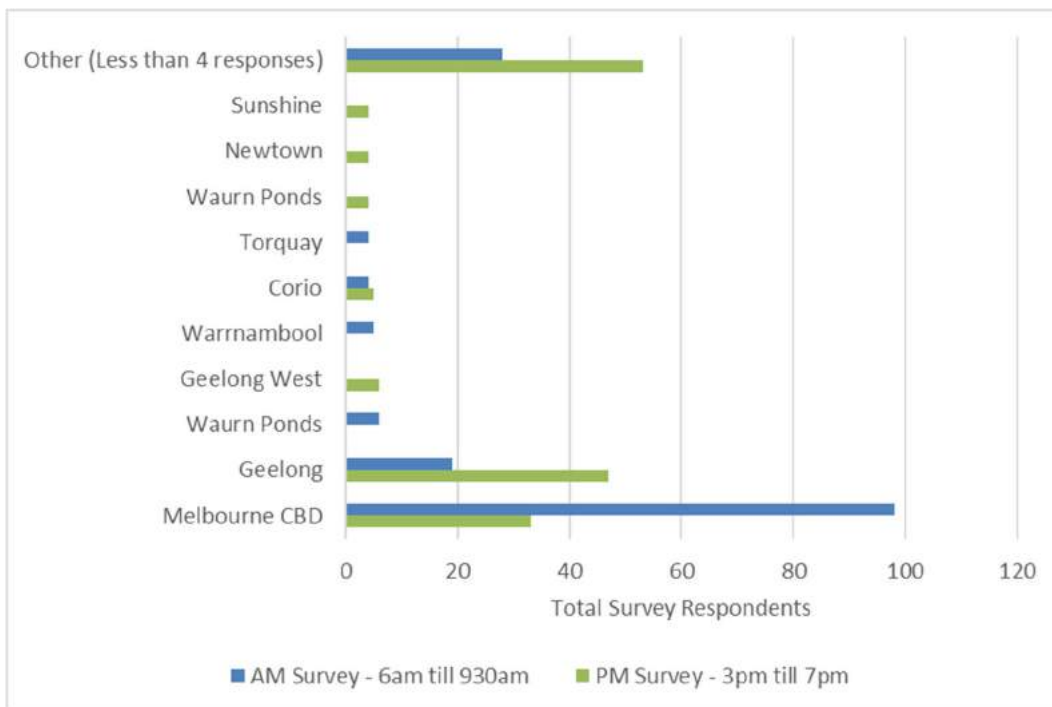
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 10 and Figure 11.
- The respondents travel purposes are surmised in Figure 12.
- The respondents indicative travel times are outlined in Figure 13.

Figure 48 Geelong Station commuter origins – AM and PM survey periods



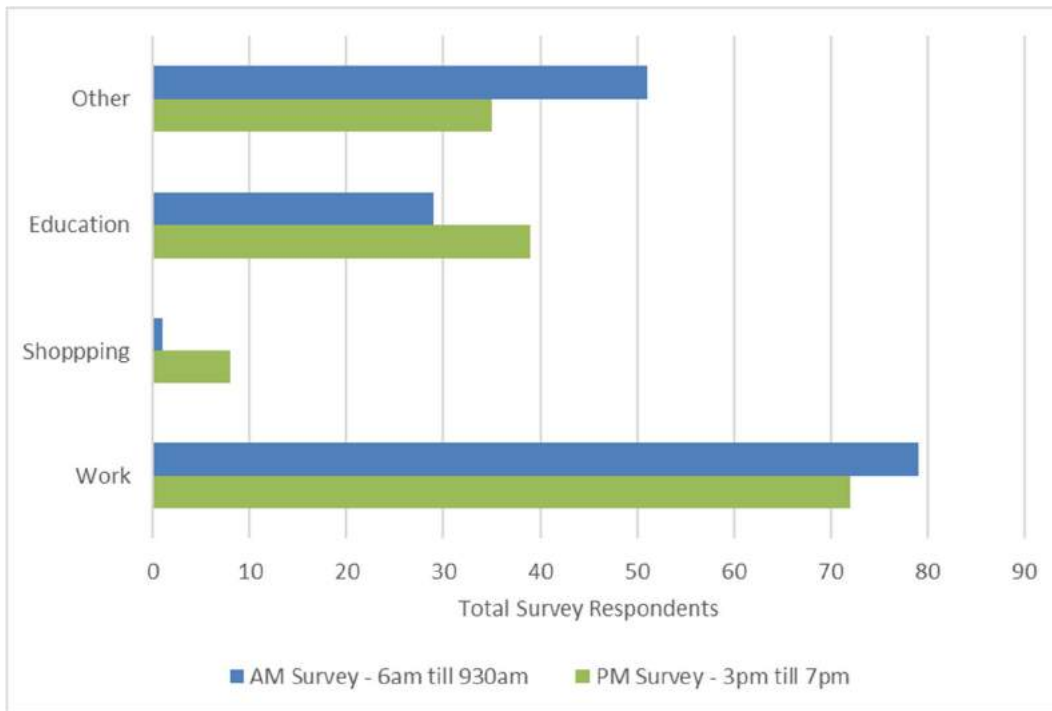
As shown the majority of commuters originate from Geelong/Geelong West in the morning. With the most commuters travelling back to Geelong from Melbourne CBD in the evening.

Figure 49 Geelong Station commuter destinations – AM and PM survey periods



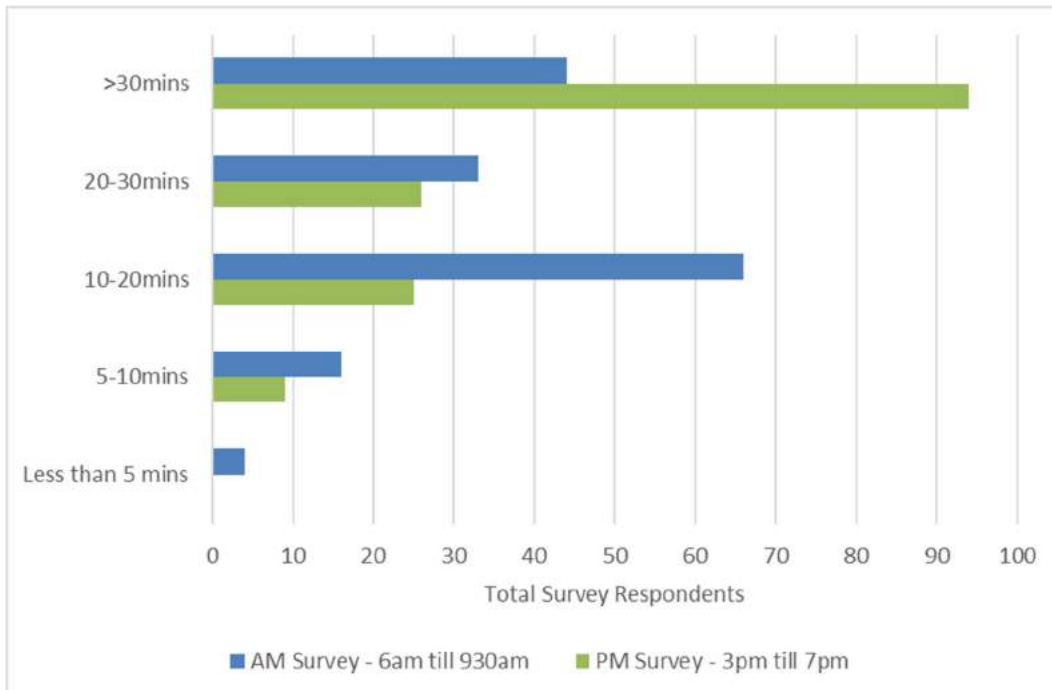
As shown the majority of commuters are travelling to Melbourne CBD during the morning survey period, with those travelling in the evening split between those outbound to Melbourne CBD and those returning commuters travelling home back to Geelong.

Figure 50 Geelong Station commuter travel purpose



Most commuters are travelling to work (49%) during the morning survey period, with 32% for other reasons. In the evening peak period the majority 47% of travelling to work, 25% education and 23% for other reasons.

Figure 51 Geelong Station commuter travel times



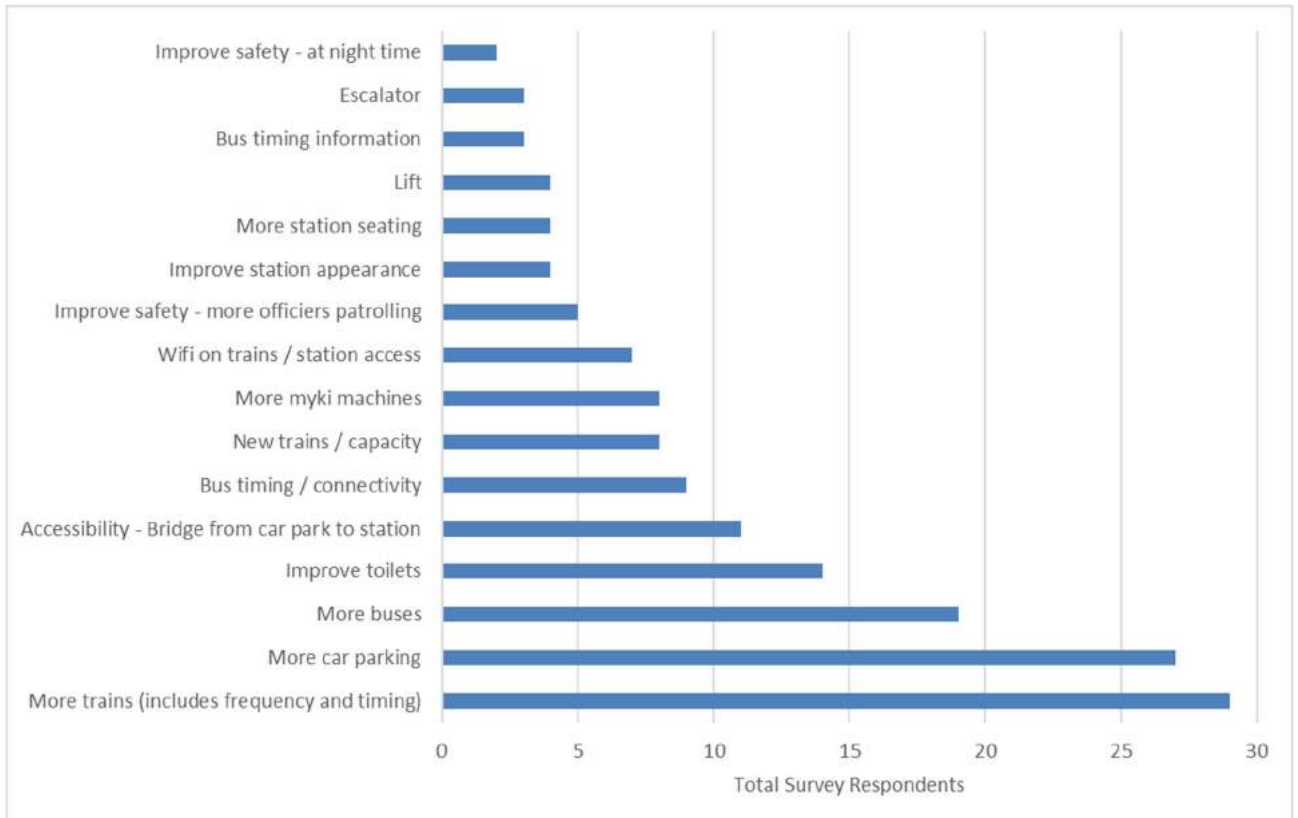
Commuters were asked how long their respective journeys took from their point of origin. 52% of respondents travelled less than 20 minutes to Geelong Station during the morning survey period, with 27% travelling more than 30 minutes, likely incoming commuter workers.

61% of commuters travel longer than 30 minutes in the evening survey period, which is due to worker commuters coming back from Melbourne CBD to Geelong.

1.5.5.5 Geelong Station – suggested improvements

Geelong Station commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 52 Geelong Station – suggested improvements



The following can be noted from the above suggested improvements to either Geelong Station or local links. The highest frequency respondents (more than 10) have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following was noted:
 - 17% of respondents wanted more car parking at Geelong Station
 - 9% requested that the toilets are improved.
 - 7% suggested better accessibility to the station (a bridge from the car park to the station)
- In terms of 'soft' measures, the following was noted:
 - 18% requested for more trains (frequency and timings)
 - 12% requested more buses.

1.6 South Geelong Station existing usage

1.6.1 Car parking

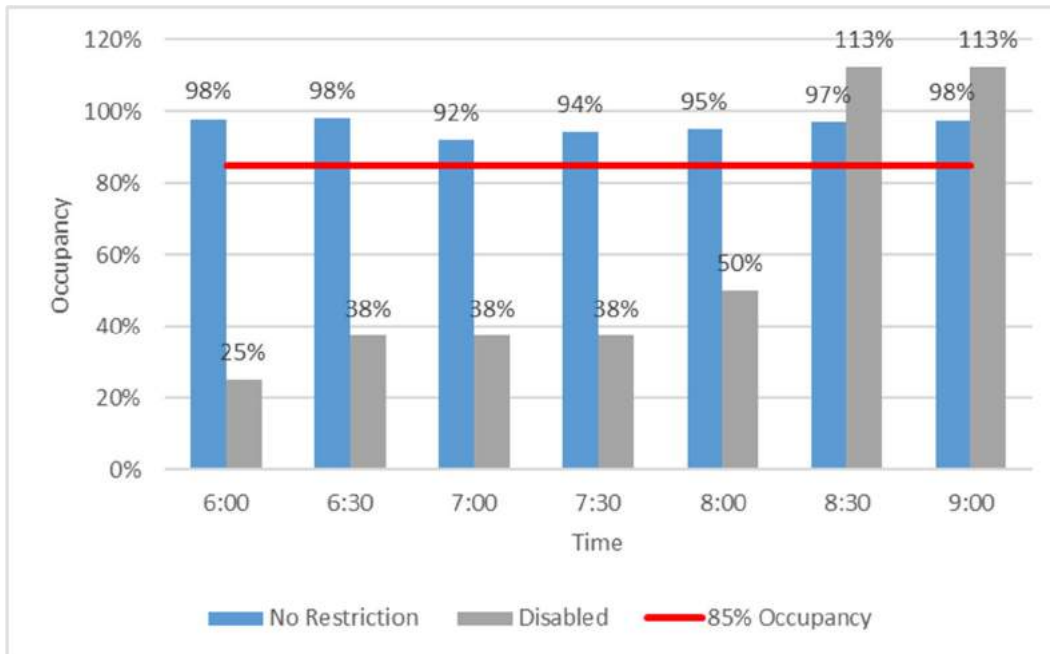
1.6.1.1 Off-street parking

A total of 558 off-street carparking spaces were recorded at South Geelong Station. These consist of:

- 545 car parking spaces with no restrictions.
- Five '10-minute' kiss and ride spaces.
- Eight disabled spaces.

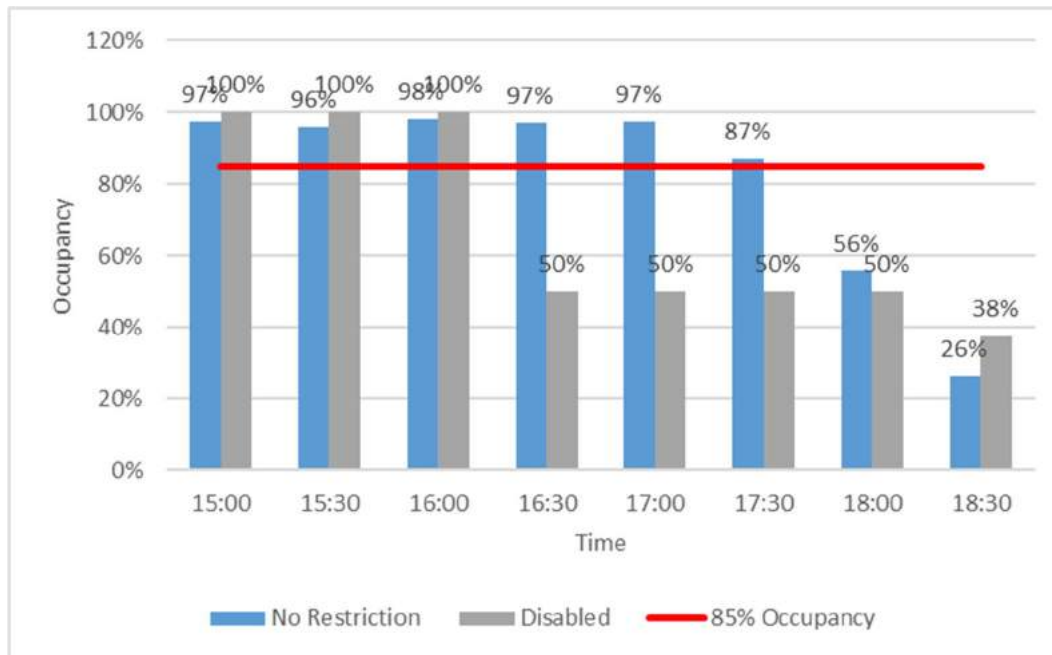
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 53 and Figure 54.

Figure 53 South Geelong Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 54 South Geelong Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 53 and Figure 54:

- 98% (532 of the 545-space occupied, with only 13 spaces available) of parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey.
- By the commencement of the evening peak occupancy survey 97% of available parking spaces were occupied, with only 15 spaces available.
- Disabled parking provision were all occupied with over 100% of spaces occupied at 8:30 am.

Table 17 provides a summary of the supply and demand of parking spaces for the off-street carpark at South Geelong Station.

Table 17 Overview of Supply and Demand of off-street carparking spaces at South Geelong Station

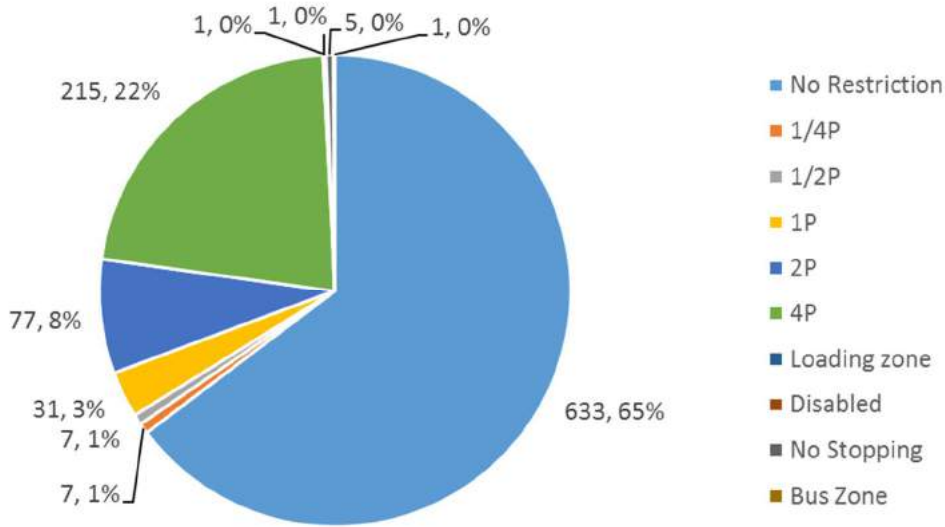
Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	545	532	98%	09:00	389	71%	13:30
Disabled	8	9	113%	08:30 to 09:00	11	138%	12:00
P10 minutes	5	3	60%	6:00, 7:00, 15:00 15:30 and 17:30	4	80%	11:30
Total car parking	558	542	97%	09:00	398	71%	13:30

It can be noted from Table 17 that the formal carpark at South Geelong Station was surveyed to be operating at a maximum of 97%.

1.6.1.2 On-street parking

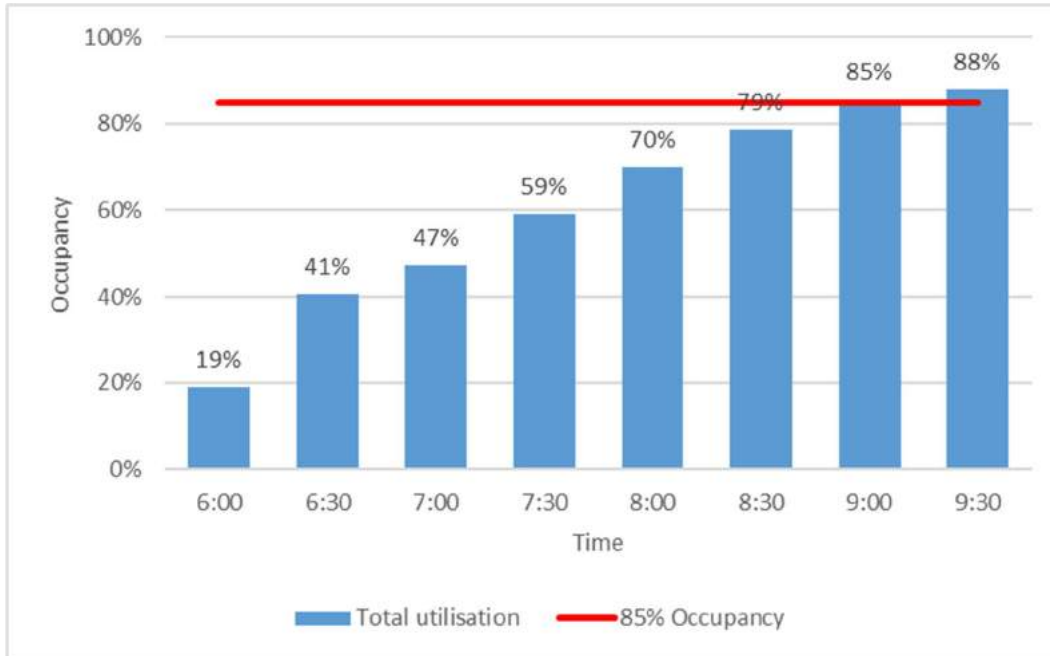
A total of 978 on-street car parking spaces were surveyed near South Geelong Station. The extents of the survey and restrictions in place are shown in Figure 55. As shown most of the on-street parking spaces are unrestricted (633), with timed parking spaces ranging from 4P (215), 2P (77) and 1P (31) also prominently provided in the area.

Figure 55 South Geelong – on-street car parking restrictions overview



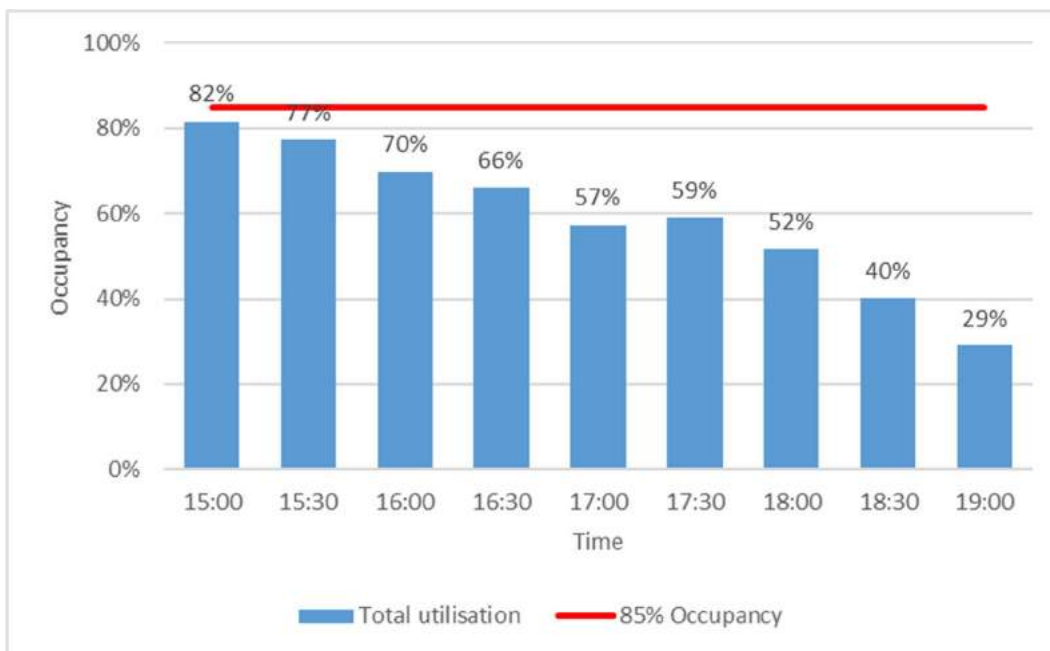
The occupancy survey results of the on-street car parking near South Geelong Station on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) survey periods are shown in Figure 56 and Figure 57.

Figure 56 South Geelong Station - on-street car parking occupancy – morning survey period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 57 South Geelong Station - on-street car parking occupancy – evening survey period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Table 18 provides a summary of the supply and demand of parking spaces for the on-street car parking near South Geelong Station.

Table 18 Overview of Supply and Demand of on-street carparking spaces local to South Geelong Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No restriction	633	603	95%	9:30	250	39%	13:00
1/4P	7	1	14%	15:00 – 15:30, 17:30	0	-	-
1/2P	7	6	86%	8:30 – 9:30	1	14%	12:00 – 14:30
1P	31	24	77%	15:00 – 15:30	8	26%	13:30
2P	77	57	74%	9:30	55	71%	12:30
4P	215	165	77%	9:30	95	44%	14:00
Loading Zone	1	1	100%	7:00, 8:30, 9:30	0	-	-
Disabled	1	1	100%	8:00 – 9:00	0	-	-
No Stopping	5	6	120%	9:00	1	20%	10:30 – 14:30
Bus Zone	1	1	100%	6:30	0	-	-
Total parking	978	859	88%	9:30	393	40%	13:00

As shown from Table 18, on the normal surveyed commuter day (Tuesday 27th March 2018) most of the on-street parking areas are over or approaching capacity, with the South Geelong off-street car being at capacity from 6:00 am, commuters are forced to park on-street. Based on the volume (859 of the 978, or 88%, on-street parking spaces being occupied at 9:30am) and time period extents the vast majority of on-street parking could be attributed to commuters.

It is likely that due to the no restriction spaces being full that those parking in the time limited areas are doing so illegally past the nominated time periods.

1.6.2 Car parking user observations

Car parking user observations found that only two patrons during the morning and evening survey periods respectively parked in the South Geelong off-street car park and did not use the station.

1.6.3 Bicycle parking

South Geelong Station has capacity for a total of 62 bicycles split between loops (36) and a parkiteer cage (which provides 12 loops and 14 hanging spaces for bicycles).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 19 and Table 20.

Table 19 South Geelong Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	36	2	3	4	5	5
	Parkiteer Cage	Loops	12	2	6	9	9
		Hanging	14	4	7	9	10
	Total	62	8	16	22	24	24
% Occupancy			13%	26%	35%	39%	39%
Informal bicycle parking		0	0	0	0	0	0

Table 20 South Geelong Station – Supply and demand bicycle parking, PM peak

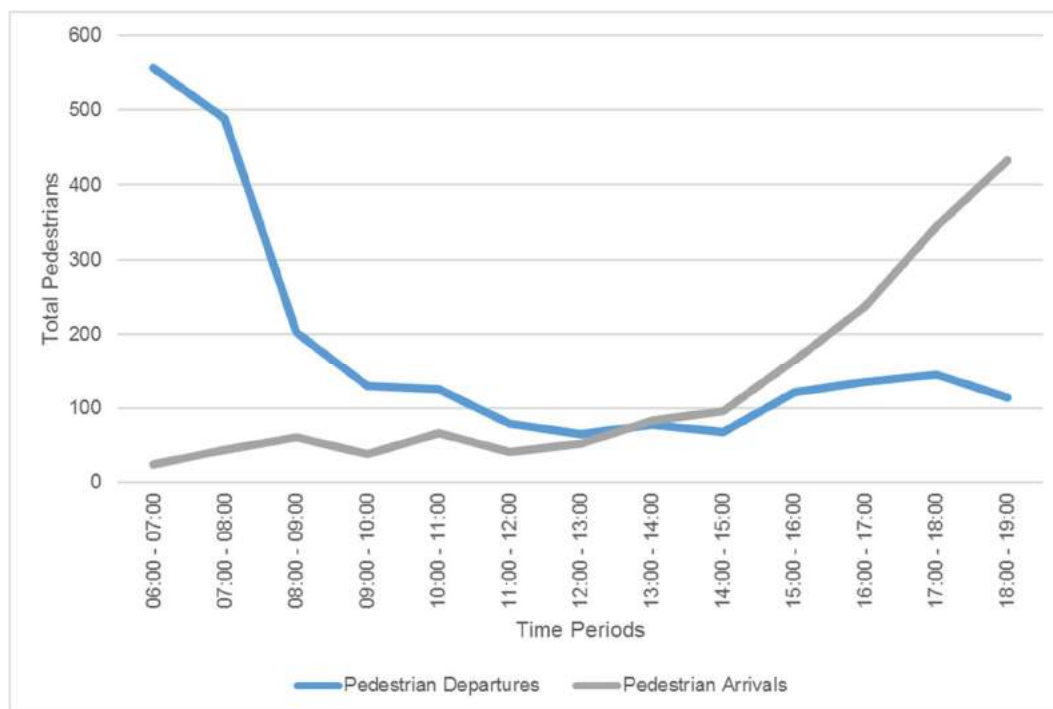
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	36	7	5	4	4	3
	Parkiteer Cage	Loops	12	8	8	8	4
		Hanging	14	10	10	10	9
	Total	62	25	23	22	17	6
% Occupancy			40%	37%	35%	27%	10%
Informal bicycle parking		0	0	0	0	0	0

As shown from Table 19 and Table 20 there is ample bicycle parking capacity at South Geelong station for the current observed demand, with a peak bicycle parking occupancy of 40 percent.

1.6.4 Station gate volumes

The pedestrian arrivals and departures at South Geelong Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours). The pedestrian flow profile over the surveyed period is shown in Figure 58.

Figure 58 South Geelong Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 58:

- A total of 3,975 pedestrians travelled via South Geelong Station over the total survey period.
- A total of 580 pedestrians (557 departing and 23 arriving) were recorded during the morning peak period between 6:00 and 7:00.
- A total of 546 pedestrians (113 departing and 433 arriving) were recorded during the evening peak period between 18:00 and 19:00.

1.6.5 Questionnaire survey findings

The questionnaire surveys at South Geelong Station received responses from 161 commuters in the AM period and 84 in the PM period.

1.6.5.1 Demographics

Survey respondents were:

- Primarily between the ages of 30-49 years old at 66%, the second largest age group were between 18-29 at 25%.
- 52% male and 48% females responded across the survey periods.
- Primarily full-time workers at 57% in the morning period and 48% in the evening period.
- Primarily travelling for work purposes in the morning period at 60%, with 22% travelling for other reasons and 17% for education. In the evening peak period 40% of respondents were travelling for 'other' reasons with 37% for work and 21% for education purposes.

1.6.5.2 Mode share

The mode choice by the survey respondents on how they travelled to South Geelong Station is shown in Figure 59. The reason of selection of this travel mode is shown in Figure 60 and Figure 61 for the morning and evening surveyed periods respectively.

Figure 59 South Geelong Station – commuter modes

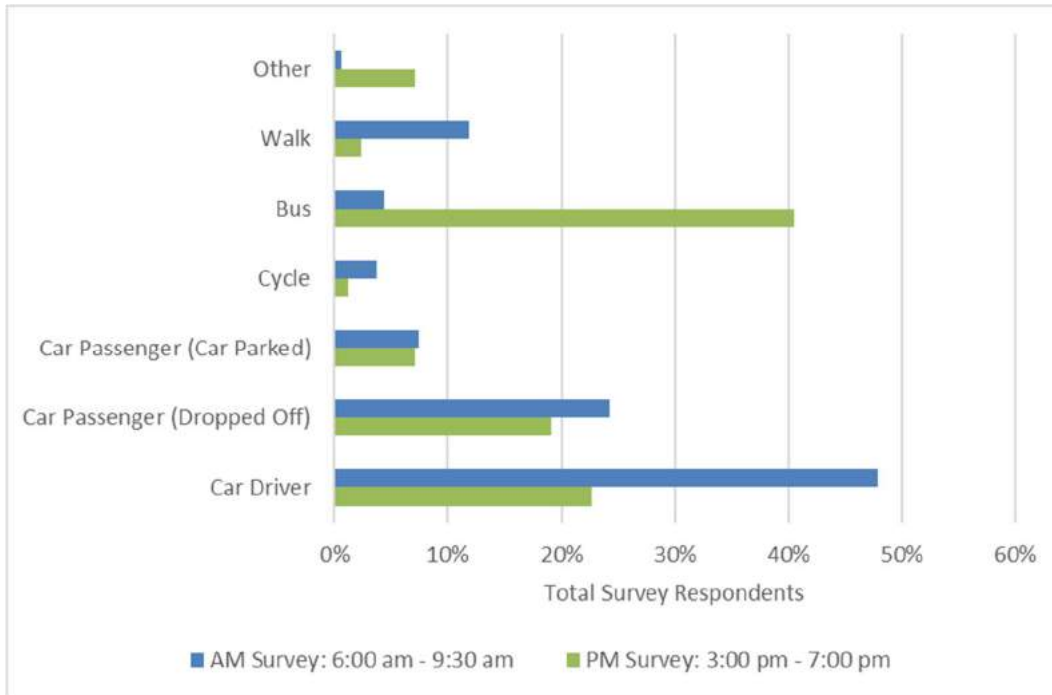


Figure 60 South Geelong Station – commuter mode choice – morning peak

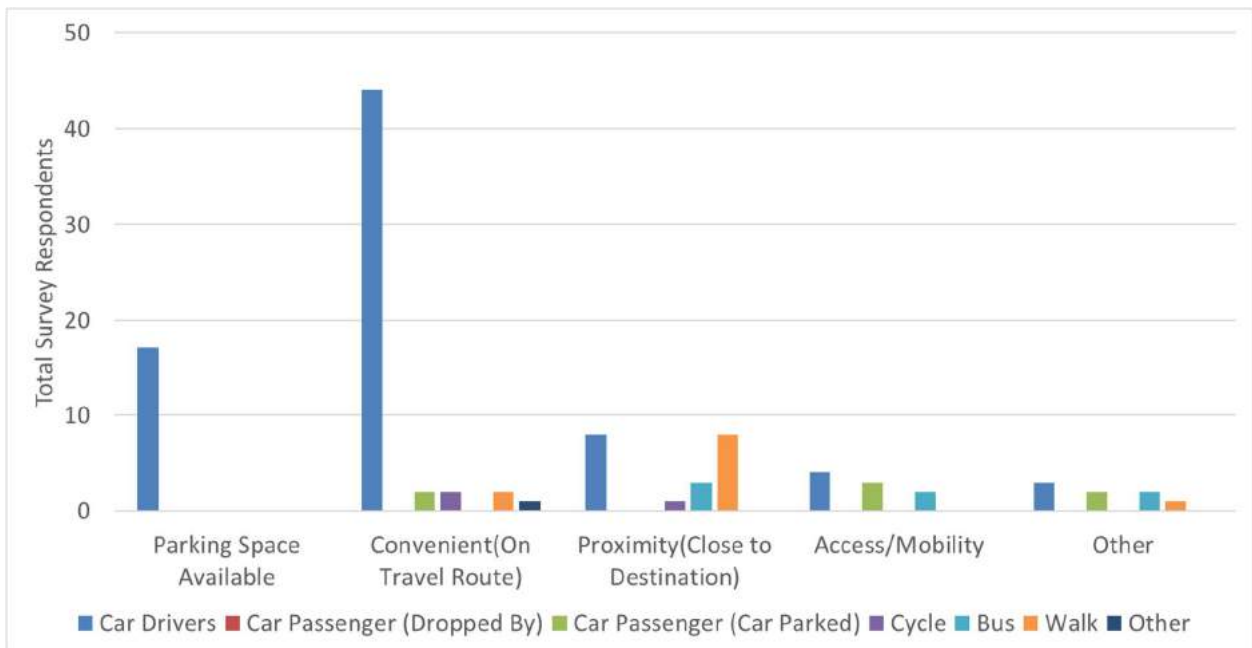
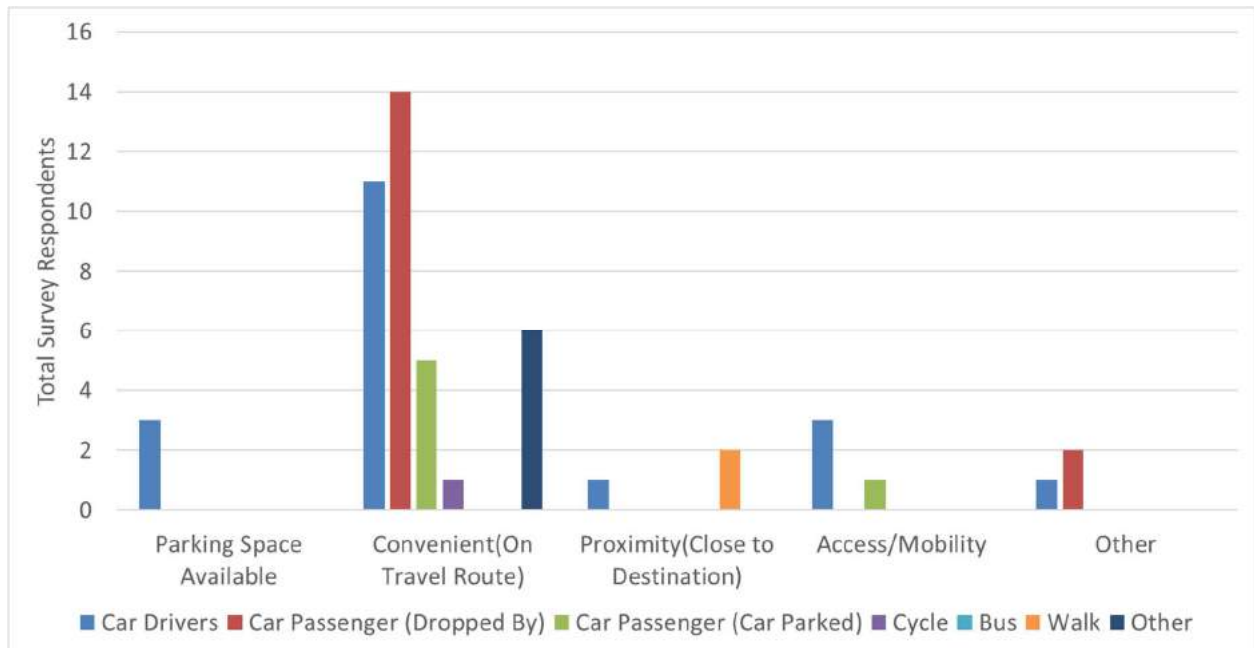


Figure 61 South Geelong Station – commuter mode choice – evening peak



The following can be noted from the South Geelong Station travel mode selection:

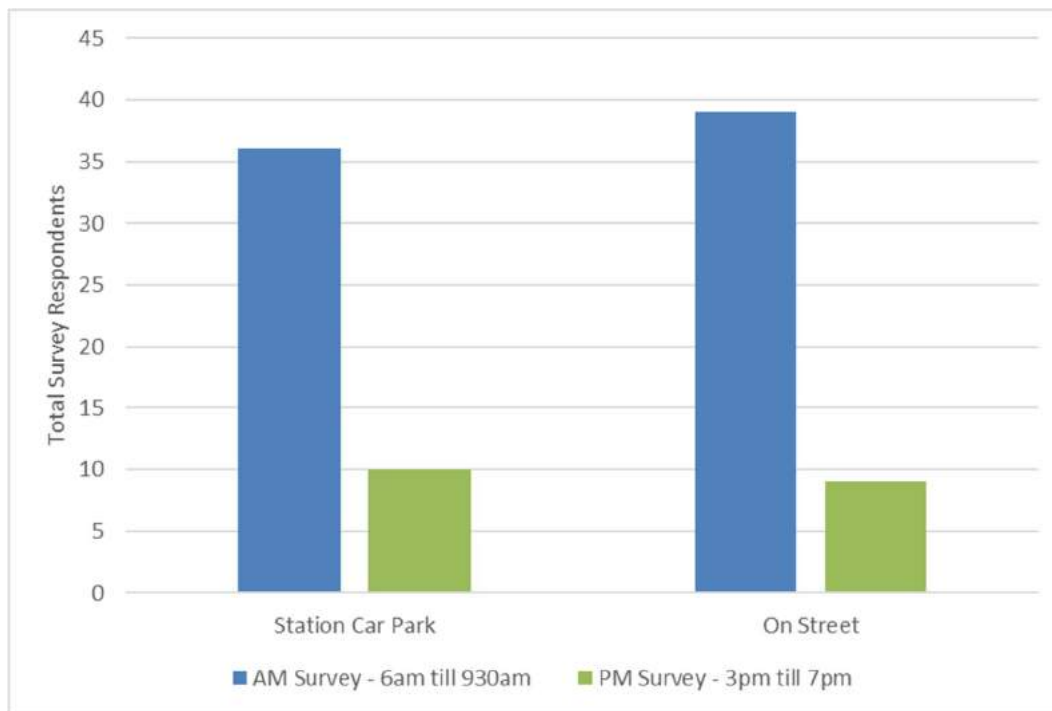
- 80% of commuter’s travel to South Geelong Station by car in the surveyed morning period with 48% being car driver, 24% being dropped off and 7% being a car passenger (car parked). With the main reasoning behind car use being the availability of car parking and convenience of the station on the persons travel route.
- 49% of commuter’s travel to/from South Geelong Station by car in the surveyed evening period with 23% being car driver 19% being dropped off and 7% being a car passenger (car parked). 40% of commuter’s in the evening chose to use the bus.

The main reasoning behind car and bus usage being the convenience of the station on the persons travel route.

1.6.5.3 Commuter parking locations

The parking locations of commuters to South Geelong Station is provided in Figure 62. As shown there is an approximate equal split between those drivers parking in the off-street station car park and on the local street.

Figure 62 South Geelong Station – commuter parking locations

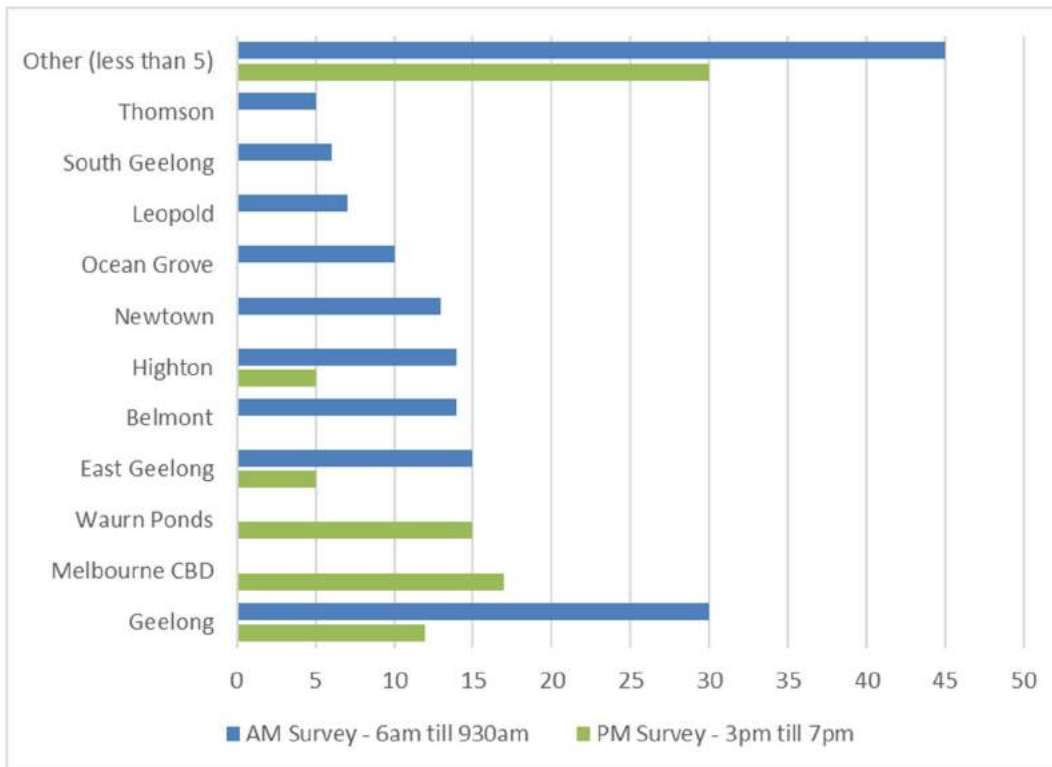


1.6.5.4 South Geelong Station commuter travel findings

The following figures show the South Geelong Station commuter travel origins/destination, travel purpose and times:

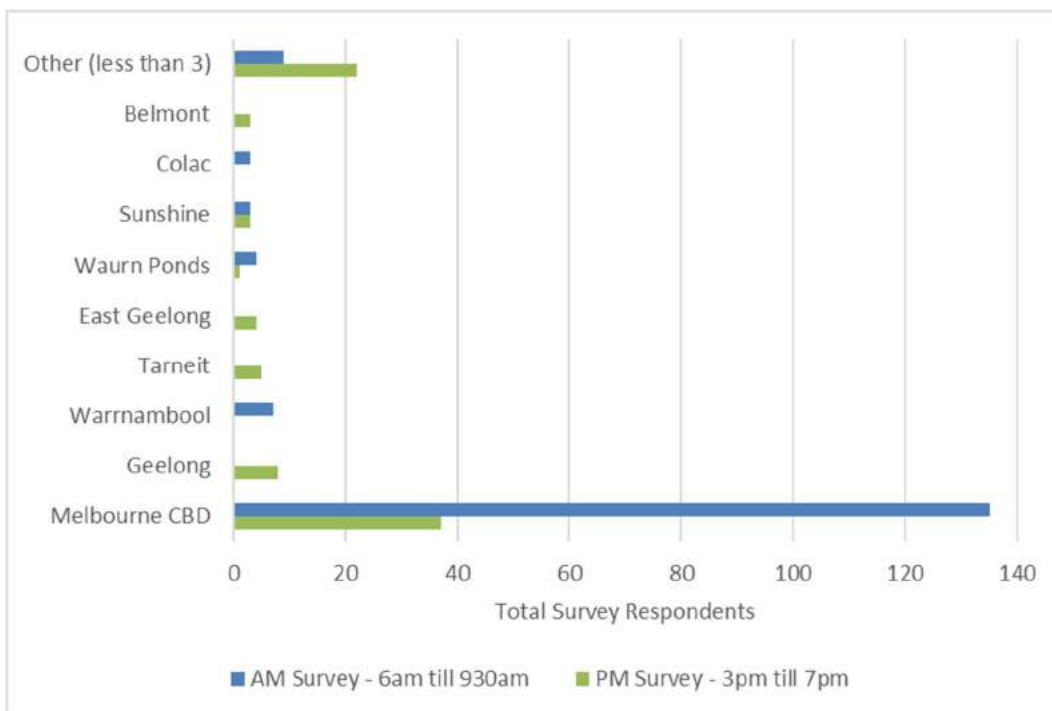
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 63 and Figure 64.
- The respondents travel purposes are surmised in Figure 65.
- The respondents indicative travel times are outlined in Figure 66.

Figure 63 South Geelong commuter origins – AM and PM survey periods



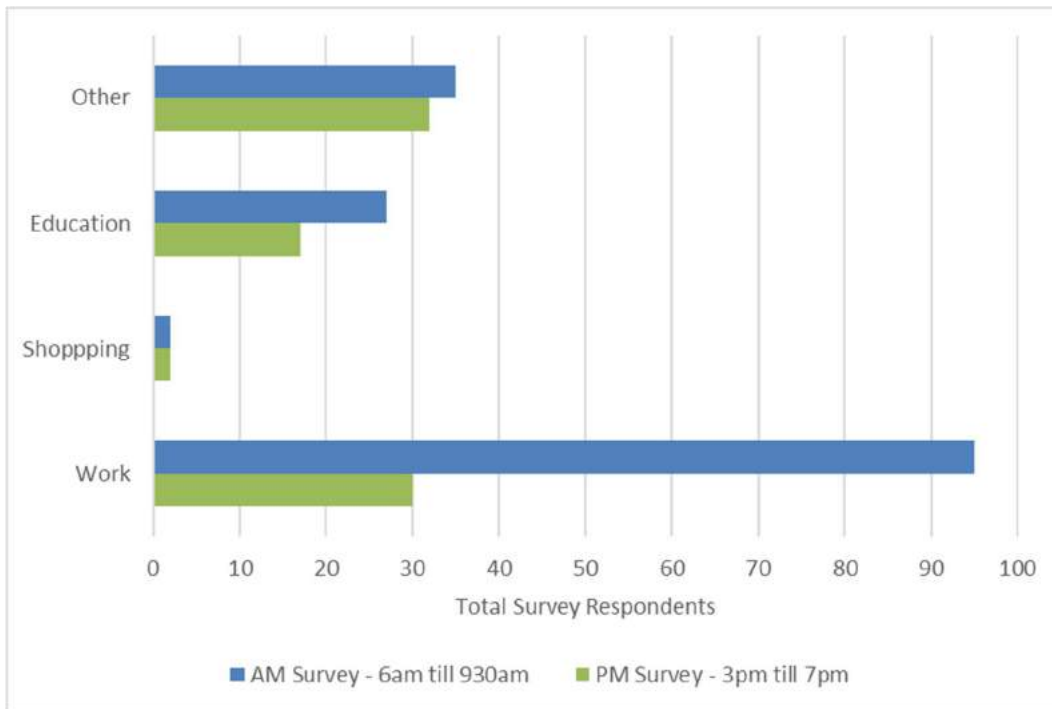
As shown most commuters originate from Geelong and the local surrounds in the morning. An increase in commuters is found from Melbourne CBD in the evening with a notable number of commuters from Waurun Ponds. (accounting for 18% of commuter responses).

Figure 64 South Geelong commuter destinations – AM and PM survey periods



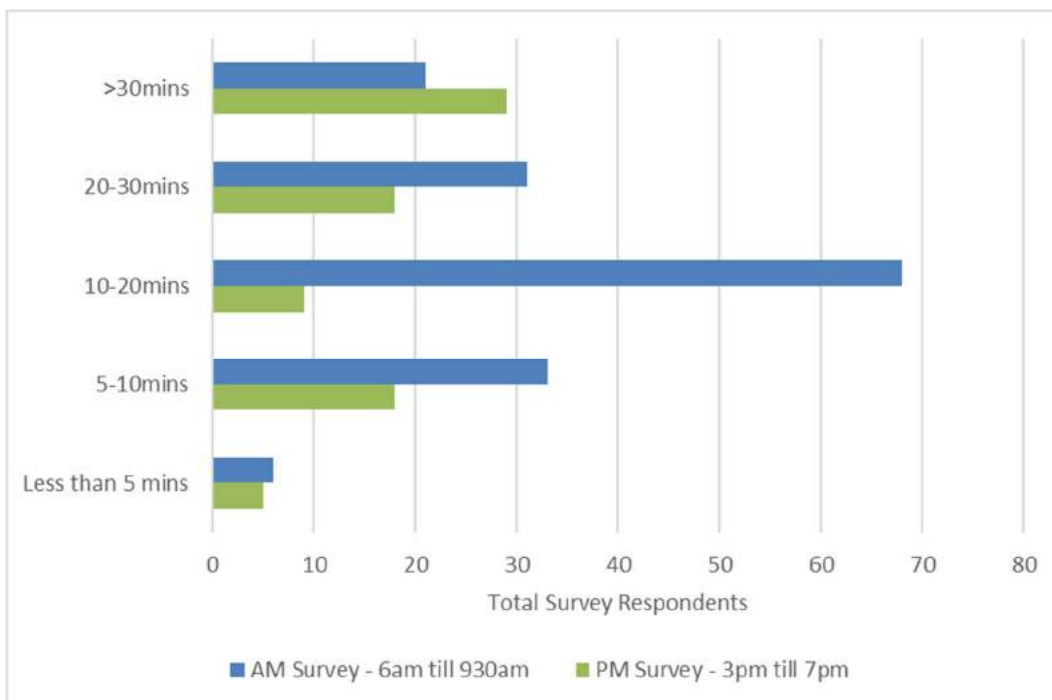
As shown the majority of commuters are travelling to/from Melbourne CBD during the morning and evening survey periods respectively.

Figure 65 South Geelong commuter travel purpose



As expected most commuters are travelling to work (60%) during the morning survey period, 22% for other reasons and 17% of respondents doing so for education purposes. In the evening peak period the main travel purposes are split between other reasons (40%) and work (37%), with education travel purposes at 21%.

Figure 66 South Geelong commuter travel times

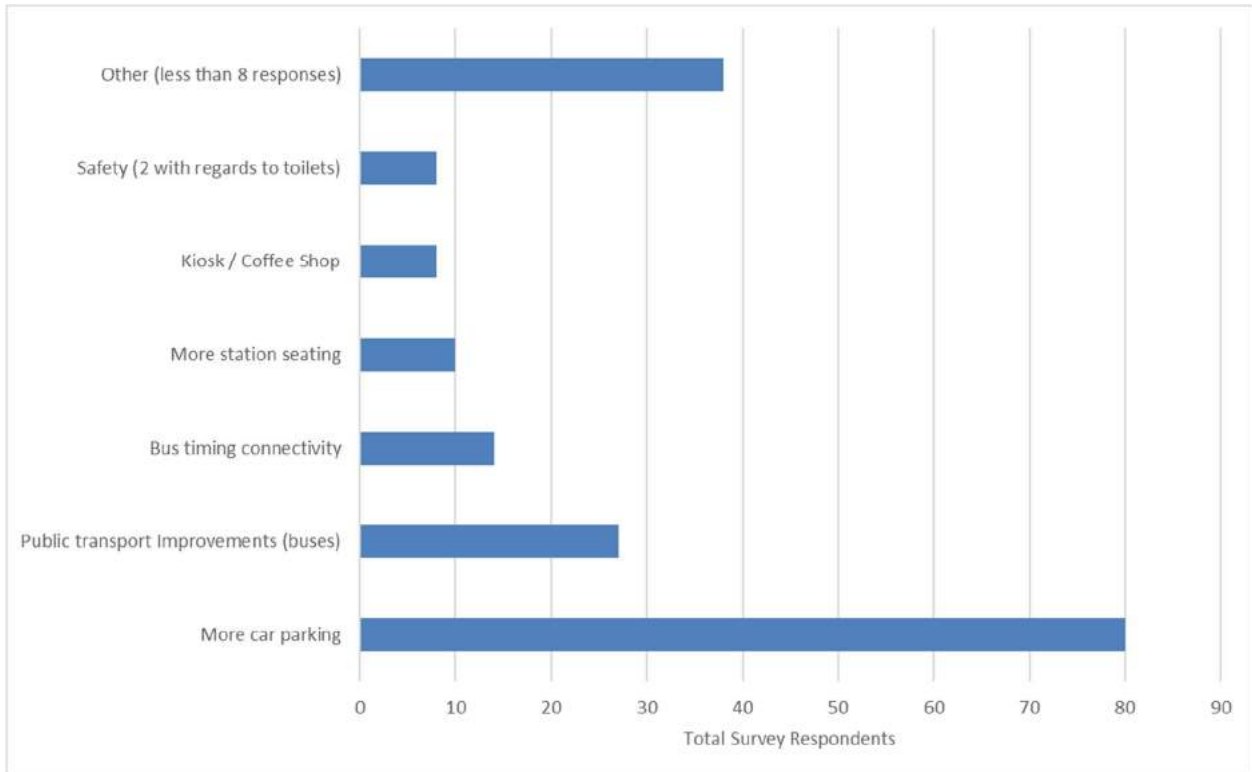


Commuters were asked how long their respective journeys took from their point of origin. 67% of respondents travelled less than 20 minutes to South Geelong Station during the morning survey period. Travel times increased during the evening peak period due to commuters travelling back from the Melbourne CBD, with 37% of respondents stating a travel time of 30 minutes or more.

1.6.5.5 South Geelong Station – suggested improvements

South Geelong commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 67 South Geelong Station – suggested improvements



The following can be noted from the above suggested improvements to either South Geelong Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following key responses were noted:
 - 43% of respondents wanted more car parking at South Geelong Station
 - 5% requested more seating at South Geelong Station.
 - 4% requested a kiosk and/or coffee facility.
 - 4% requested improvements to safety (two responders specifically to toilets provided).
- In terms of 'soft' measures, the following key responses were noted:
 - 15% suggested public transport improvements with regards to buses.
 - 8% suggested improved bus timing connectivity with South Geelong Station train services.

1.7 Marshall Station existing usage

1.7.1 Car parking

1.7.1.1 Off-street parking

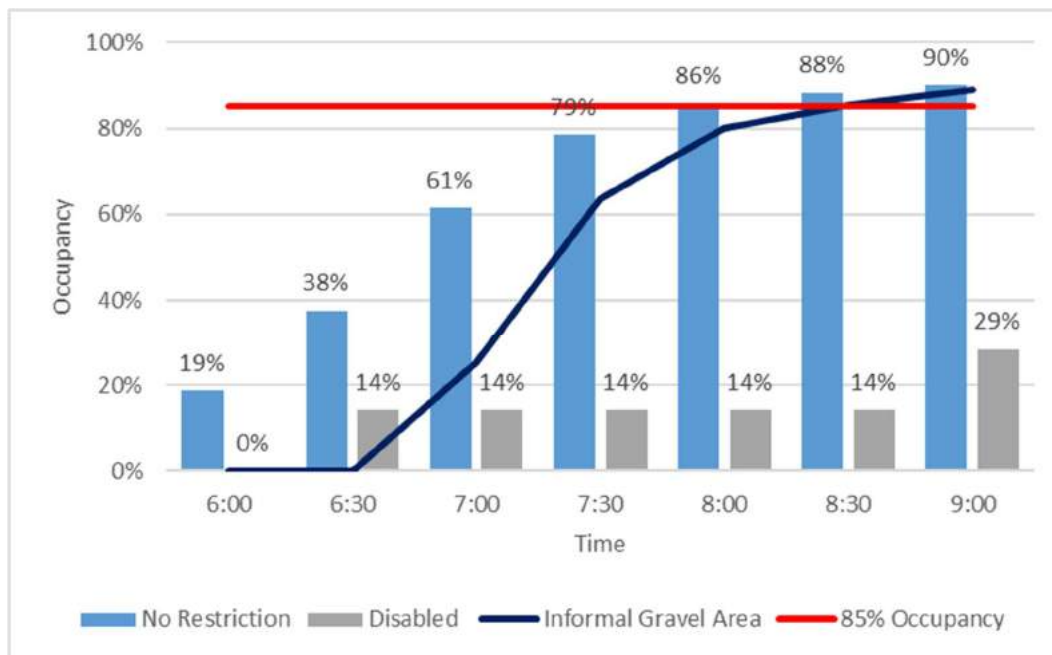
A total of 397 off-street carparking spaces were recorded at Marshall Station. These consist of:

- 378 car parking spaces with no restrictions.
- 12 kiss and ride spaces (10 P10min and two P2min spaces).
- 14 disabled spaces.

In addition, it was observed that an informal gravel area for parking was provided to the east of the southern car parking area. The parking capacity in this area was observed on site to cater for approximately 55 cars.

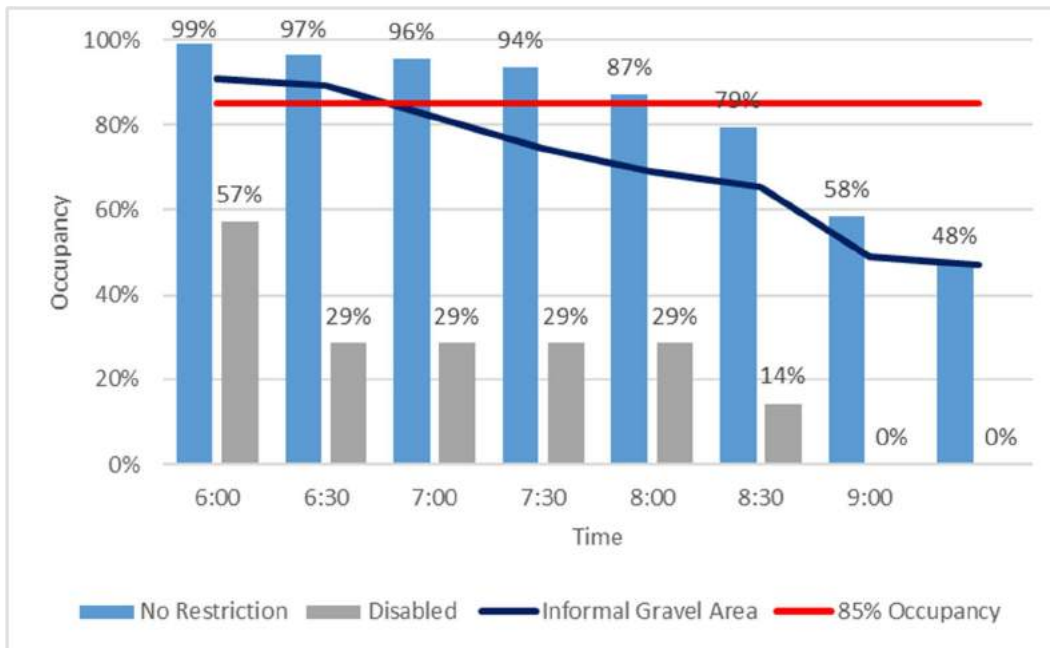
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 68 and Figure 69.

Figure 68 Marshall Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 69 Marshall Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 68 and Figure 69:

- 90% (341 of the 378 of spaces occupied, with only 37 spaces available) of parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey.
- By the commencement of the evening peak occupancy survey 99% of available parking spaces were occupied, with only 4 spaces available.
- There is ample disabled parking provision, with peak usage at 57% (four of the available seven bays being utilising).
- The informal gravel area was being utilised for parking before the formal car parking area was fully utilised, it was 91% (50 of the 55 approximated spaces filled) full by the commencement of the evening survey period.

Table 21 provides a summary of the supply and demand of parking spaces for the off-street carpark at Marshall Station.

Table 21 Overview of Supply and Demand of off-street carparking spaces at Marshall Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	378	374	99%	15:00	175	46%	14:00
Disabled	7	4	57%	15:00	7	100%	12:00 – 14:30
P2 minutes	2	1	50%	7:30, 16:00	2	100%	11:30
P10 minutes	7	4	57%	7:30	10	100%	14:00
Total formal car parking	397	381	96%	15:00	186	47%	14:00
Informal gravel car parking area	55	50	91%	15:00	22	40%	14:00 – 14:30
Total car parking	452	431	95%	15:00	208	46%	14:00

It can be noted from Table 21 that the formal carpark at Marshall Station was surveyed to be operating at a maximum of 99%, with the informal gravel parking area being at 91%.

1.7.2 Car parking user observations

Surveys showed that only a total of two drivers parking during the morning survey period did not use the car park for commuting purposes.

1.7.3 Bicycle parking

Marshall Station has capacity for a total of 29 bicycles split between loops (3) and a parkiteer cage (which provides 12 loops and 14 hanging spaces for bicycles).

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 22 and Table 23.

Table 22 Marshall Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Loops	3	1	2	2	3	3
	Parkiteer Cage	Loops	12	0	1	1	1
		Hanging	14	1	2	2	2
	Total	29	2	5	5	6	6
% Occupancy			7%	17%	17%	21%	21%
Informal bicycle parking			0	0	0	0	0

Table 23 Marshall Station – Supply and demand bicycle parking, PM peak

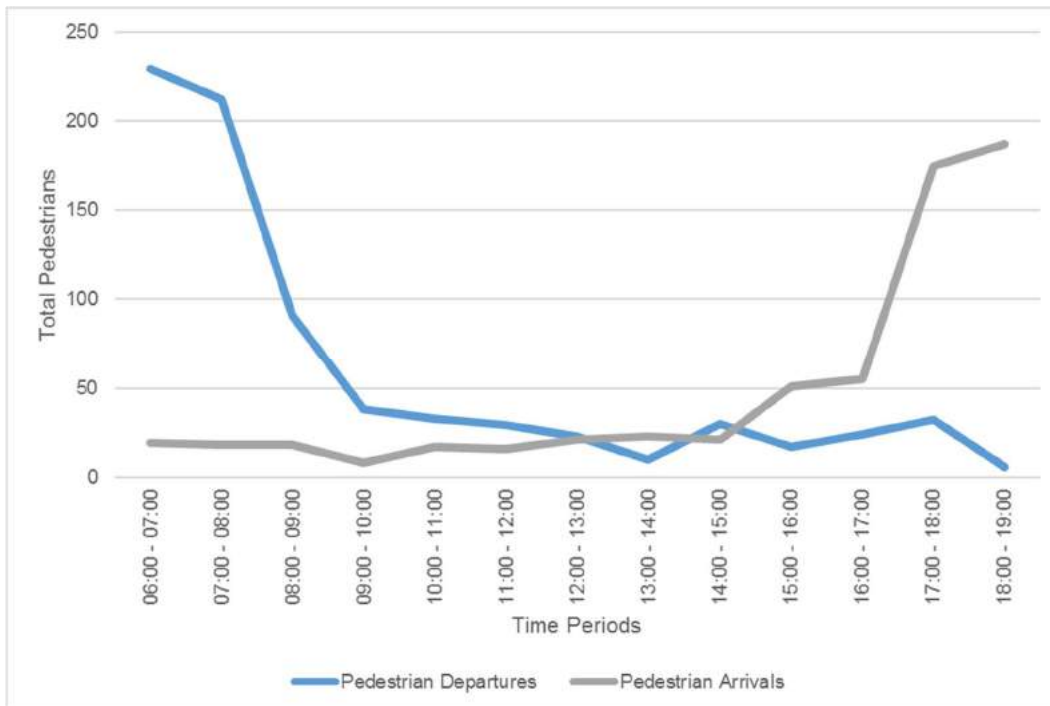
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Loops	3	4	4	4	4	4
	Parkiteer Cage	Loops	1	1	1	0	0
		Hanging	14	3	3	3	2
	Total	29	8	8	8	7	6
% Occupancy			28%	28%	28%	24%	21%
Informal bicycle parking			0	0	0	0	0

As shown from Table 22 and Table 23, there is sufficient bicycle parking capacity at Marshall Station to meet existing demand, with a peak bicycle parking occupancy of 28 percent.

1.7.4 Station gate volumes

The pedestrian arrivals and departures at Marshall Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours). The pedestrian flow profile over the surveyed period is shown in Figure 70 .

Figure 70 Marshall Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 70:

- A total of 1,403 pedestrians travelled via Marshall Station over the total survey period.
- A total of 248 pedestrians (229 departing and 19 arriving) were recorded during the morning peak period between 6:00 and 7:00.
- A total of 207 pedestrians (32 departing and 175 arriving) were recorded during the evening peak period between 17:00 and 18:00.

1.7.5 Questionnaire survey findings

The questionnaire surveys at Marshall Station received responses from 72 commuters in the AM period and 32 in the PM period.

1.7.5.1 Demographics

Survey respondents were:

- Mainly split between the age groups of 18-29 years old at 37% and 30-49 years old at 33%.
- 58% male and 42% females in both the morning and evening survey periods.
- Primarily full-time workers at 45% in the morning period and 48% in the evening period. Students being the second largest group with 40% in the morning period and 25% in the evening period.
- Primarily travelling for work purposes in the morning period at 66%, with 28% travelling for education purposes. In the evening peak period 52% of respondents were travelling for 'other' reasons with only 23% for work and 16% for education purposes.

1.7.5.2 Mode share

The mode choice by the survey respondents on how they travelled to Marshall Station is shown in Figure 71. The reason of selection of this travel mode is shown in Figure 72 and Figure 73f or the morning and evening surveyed periods respectively.

Figure 71 Marshall Station – commuter modes

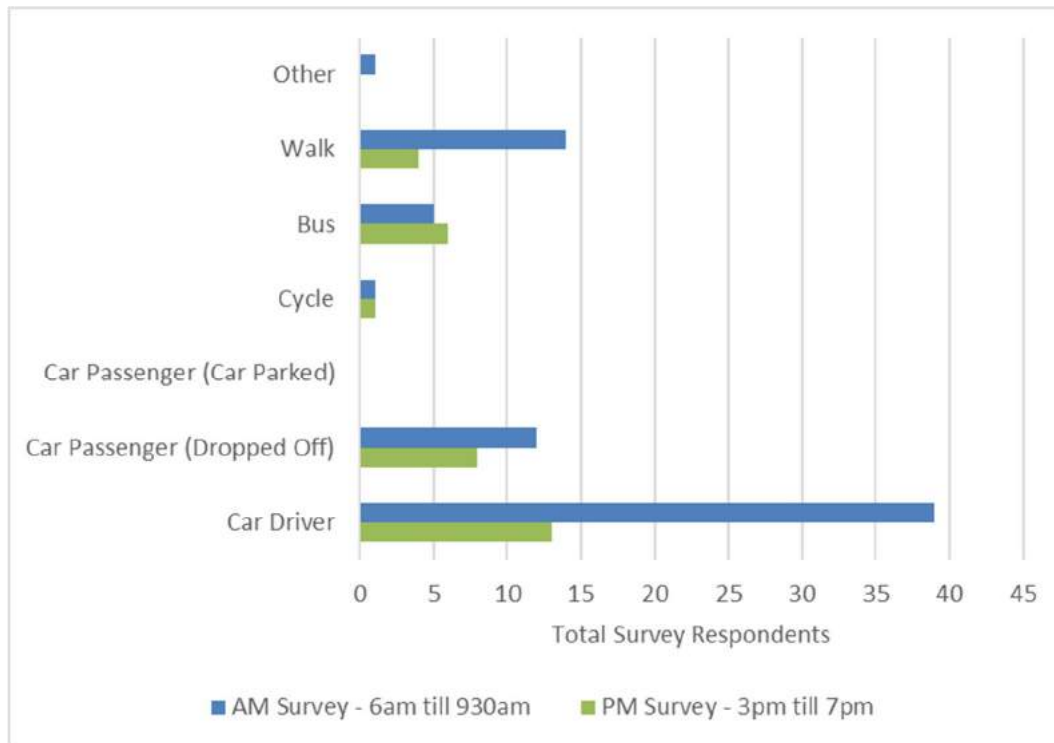


Figure 72 Marshall Station – commuter mode choice – morning peak

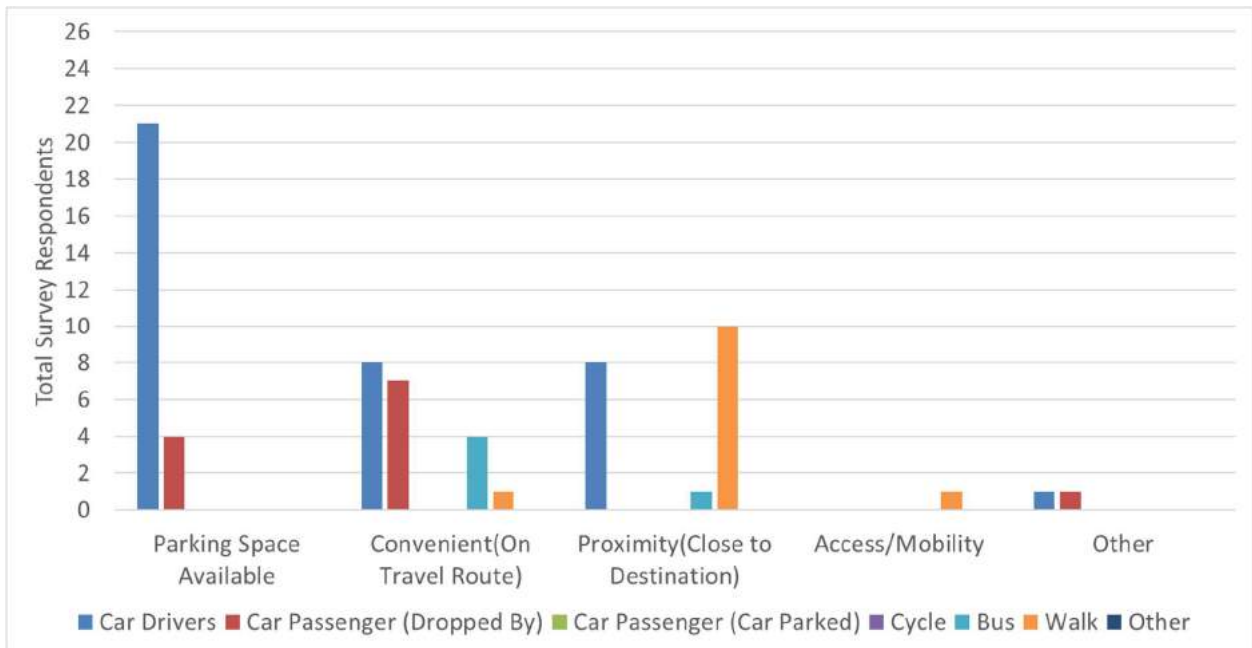
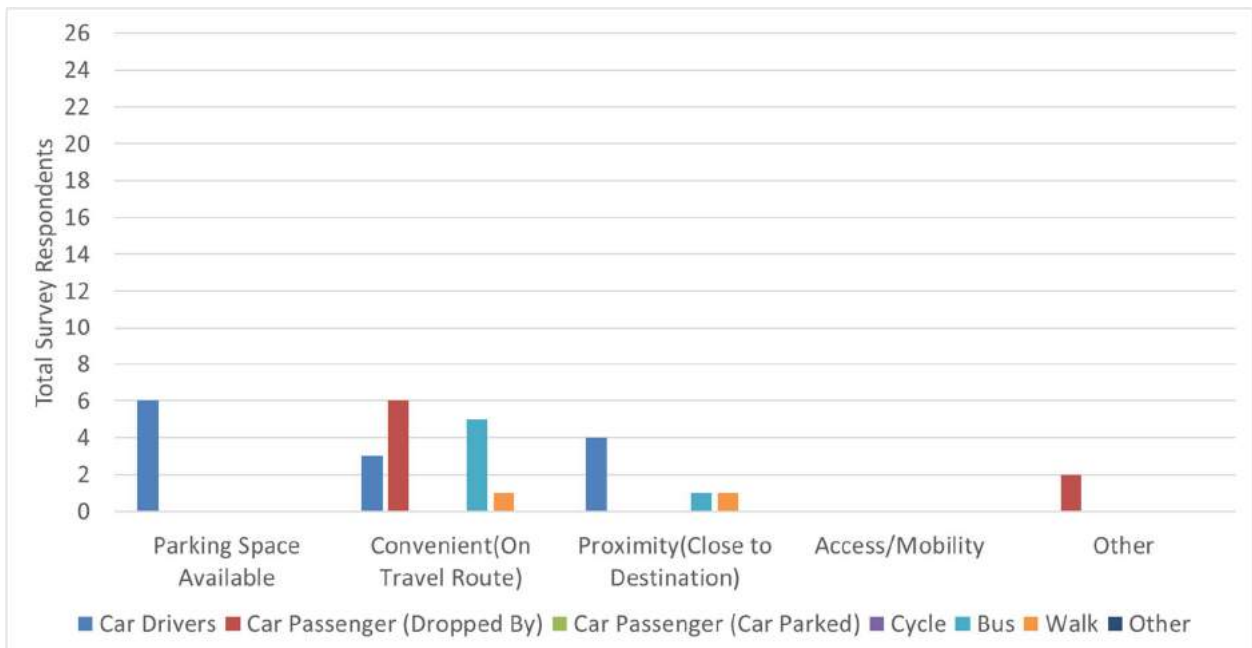


Figure 73 Marshall Station – commuter mode choice – evening peak



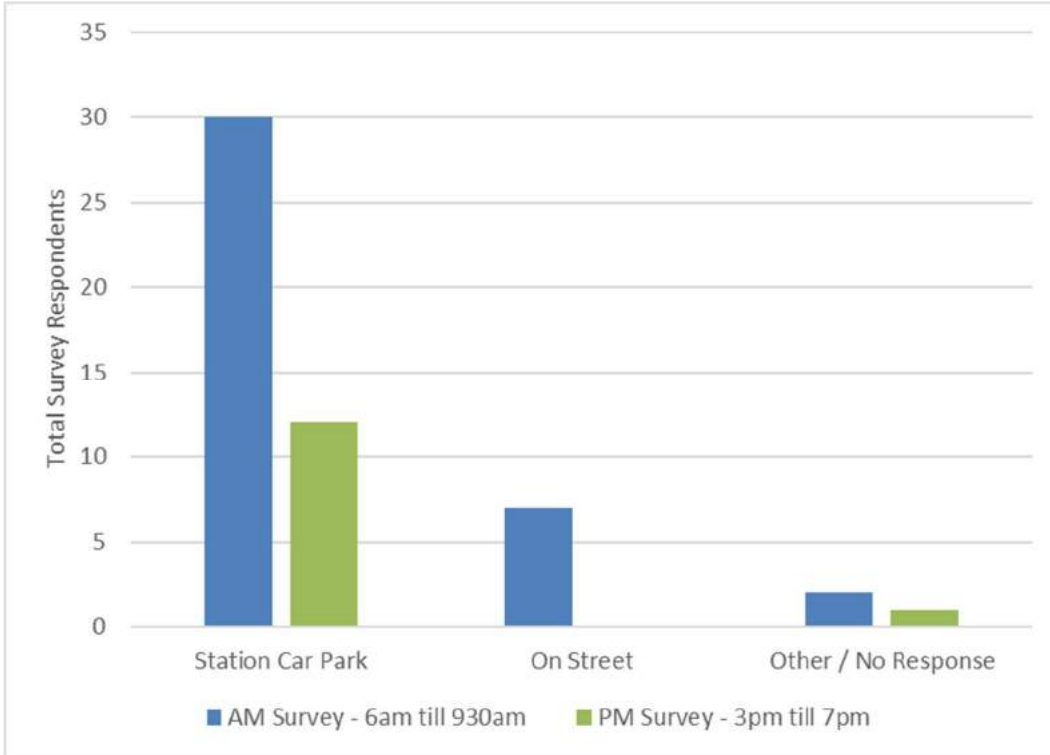
The following can be noted from the Marshall Station travel mode selection:

- 71% of commuter’s travel to Marshall Station by car in the surveyed morning period with 54% being car driver and 17% being dropped off. 19% of commuters walked to the station. The main reasoning behind car usage was the availability of car parking at the station. Whilst, walking was due to the proximity of the station.
- 66% of commuter’s travel to Marshall Station by car in the surveyed evening period with 41% being car driver and 25% being dropped off. 19% of commuters used the bus with 13% choosing to walk. Mode choice for those travelling by car was split between available parking, convenience of the station on the drivers travel route and proximity to the station.

1.7.5.3 Commuter parking habits

The parking habits of commuters to Marshall Station is provided in Figure 74. As shown the majority parked in the off-street station car park.

Figure 74 Marshall Station – commuter parking location

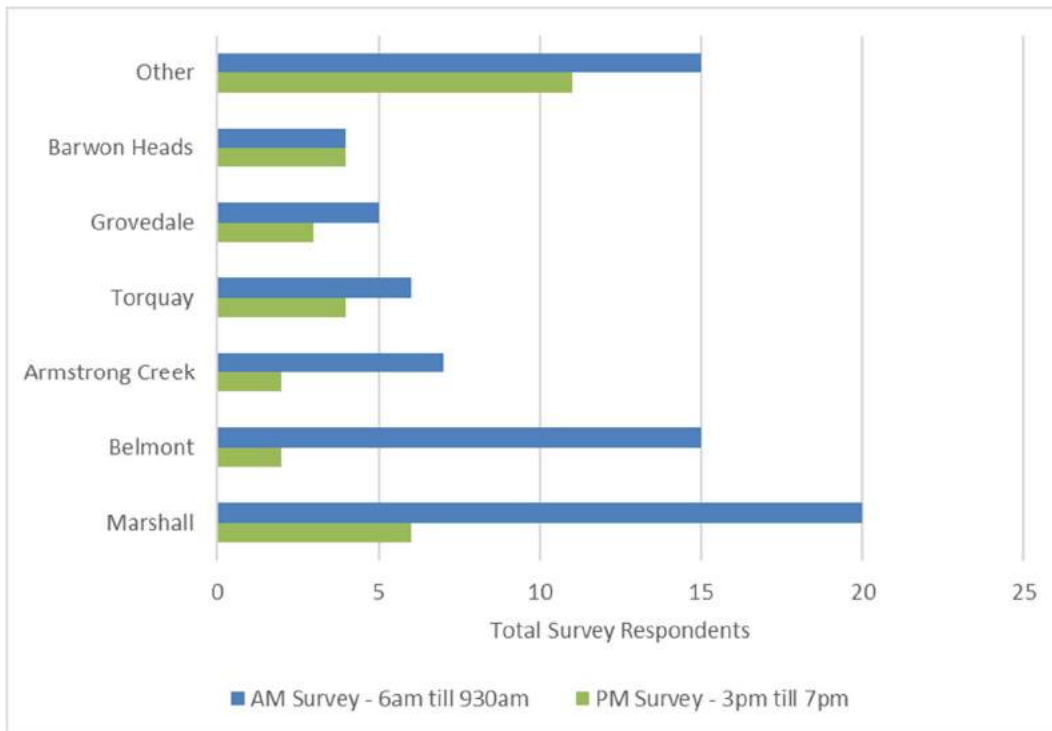


1.7.5.4 Marshall Station commuter travel findings

The following figures show the Marshall Station commuter travel origins/destination, travel purpose and times:

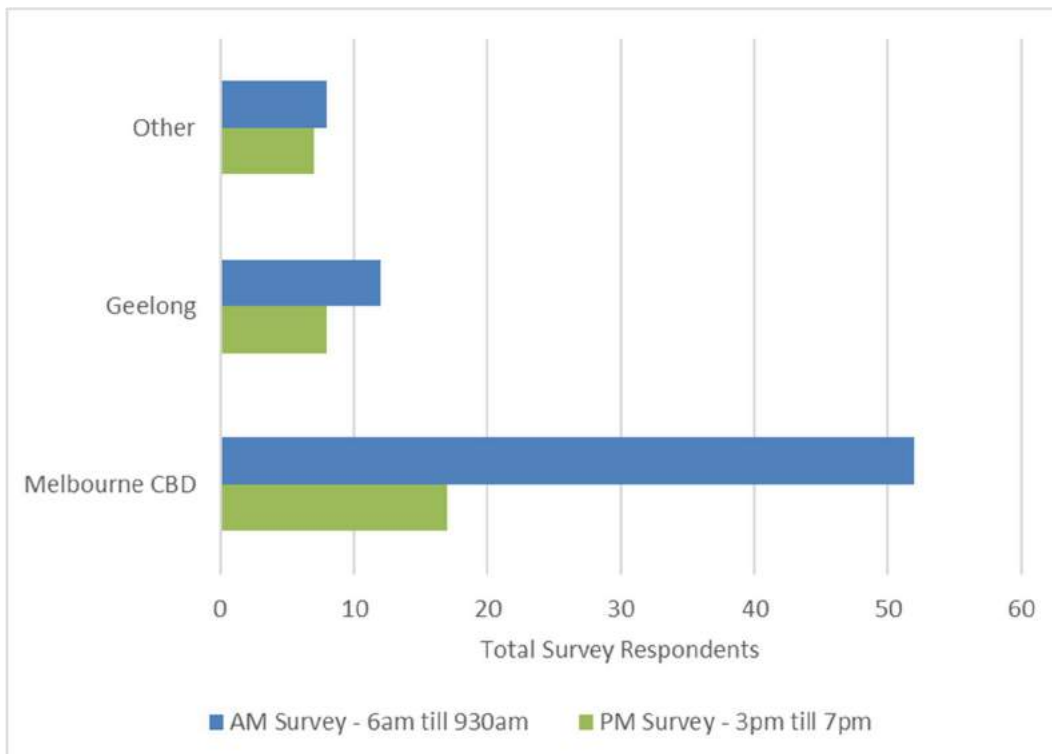
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 75 and Figure 76.
- The respondents travel purposes are surmised in Figure 77.
- The respondents indicative travel times are outlined in Figure 78.

Figure 75 Marshall Station commuter origins – AM and PM survey periods



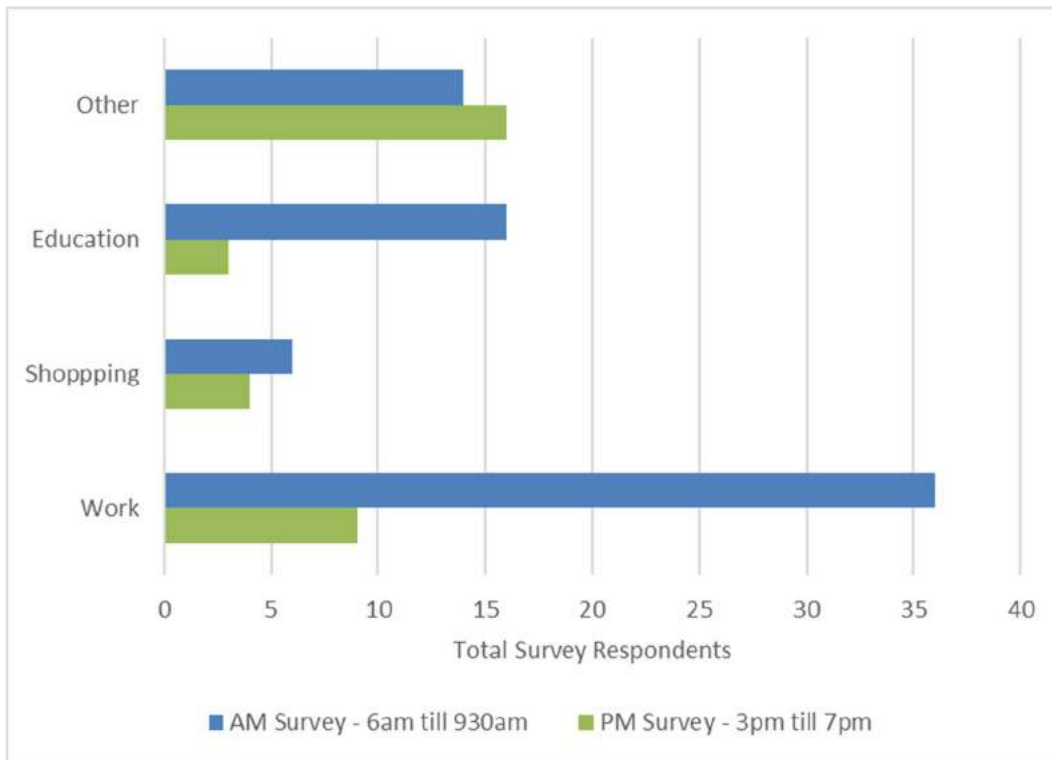
As shown most commuters originate from Marshall and Belmont in the morning. With evening commuter's origins more widely spread.

Figure 76 Marshall Station commuter destinations – AM and PM survey periods



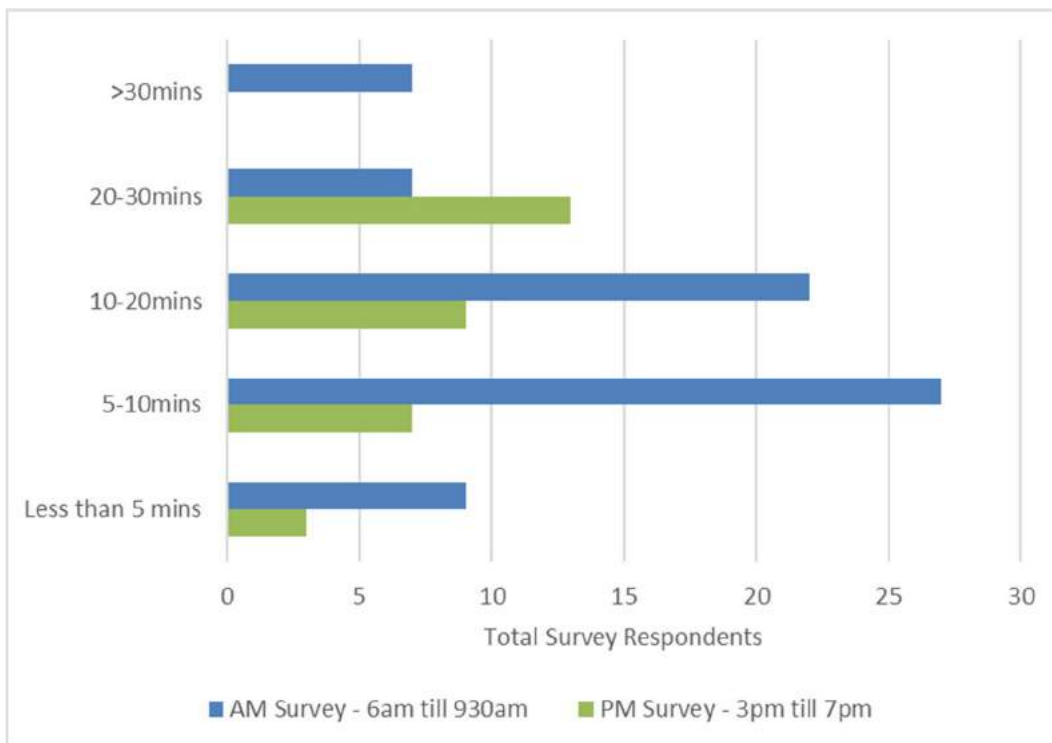
As shown the majority of commuters are travelling to Melbourne CBD during the morning survey period. Commuters in the evening are travelling to Melbourne CBD and Geelong.

Figure 77 Marshall Station commuter travel purpose



As expected most commuters are travelling to work (50%) during the morning survey period, with 22% of respondents doing so for education purposes. In the evening peak period the majority are travelling for other reasons (50%), which is likely associated with more recreational purposes.

Figure 78 Marshall Station commuter travel times



Commuters were asked how long their respective journeys took from their point of origin. 81% of respondents travelled less than 20 minutes to Marshall Station during the morning survey period.

Travel times increased during the evening peak period due to commuters travelling back from the Melbourne CBD, with 41% of respondents stating a travel time of 20 minutes or more.

1.7.5.5 Marshall Station – suggested improvements

Marshall Station commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 14.

Figure 79 Marshall Station – suggested improvements



The following can be noted from the above suggested improvements to either Marshall Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following was noted:
 - 34% of respondents wanted more car parking at Marshall Station.
 - 14% of respondents asked for a better station shelter or a waiting room/
 - 5% requested better security.
 - 5% requested more seating at the station.
- In terms of 'soft' measures, the following was noted:
 - 22% of respondents requested for more trains from the station.
 - 12% suggested public transport improvements to the station.
 - 9% requested for the frequency of buses to the increased to the station.

1.8 Waurm Ponds Station existing usage

1.8.1 Car parking

1.8.1.1 Off-street parking

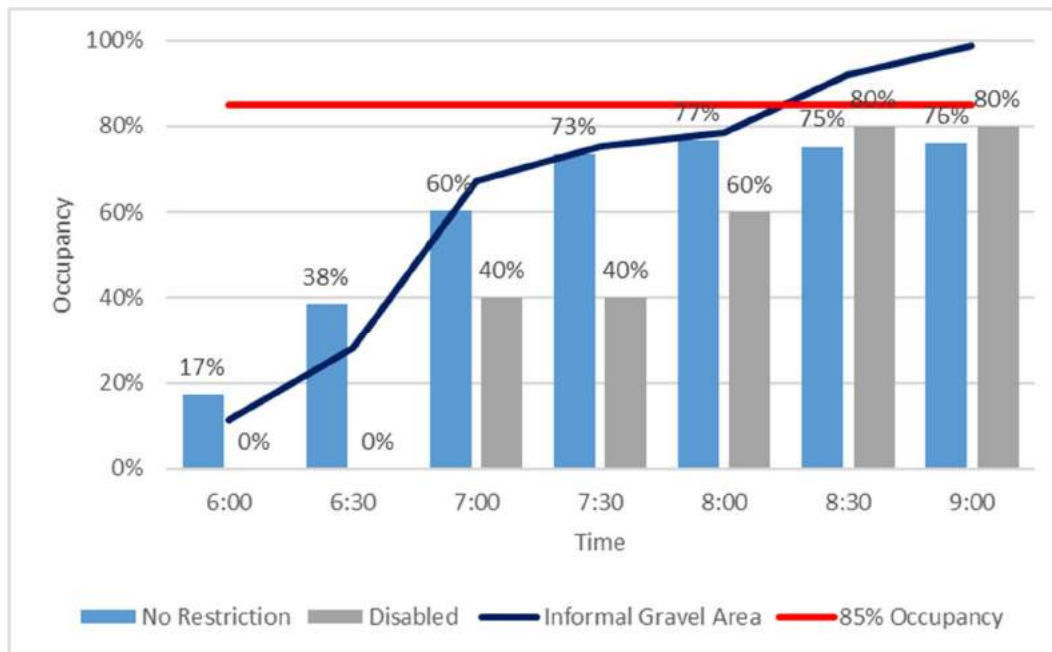
A total of 291 off-street carparking spaces were recorded for Waurm Ponds Station. These consist of:

- 279 car parking spaces with no restrictions.
- Seven kiss and ride spaces (consisting of four 'two-minute' and three 'five-minute' time limited spaces).
- Five disabled spaces.

In addition, it was observed that the gravel area to the east of the off-street carpark is used informally by commuters. The parking capacity in this area was observed on site to cater for approximately 89 cars.

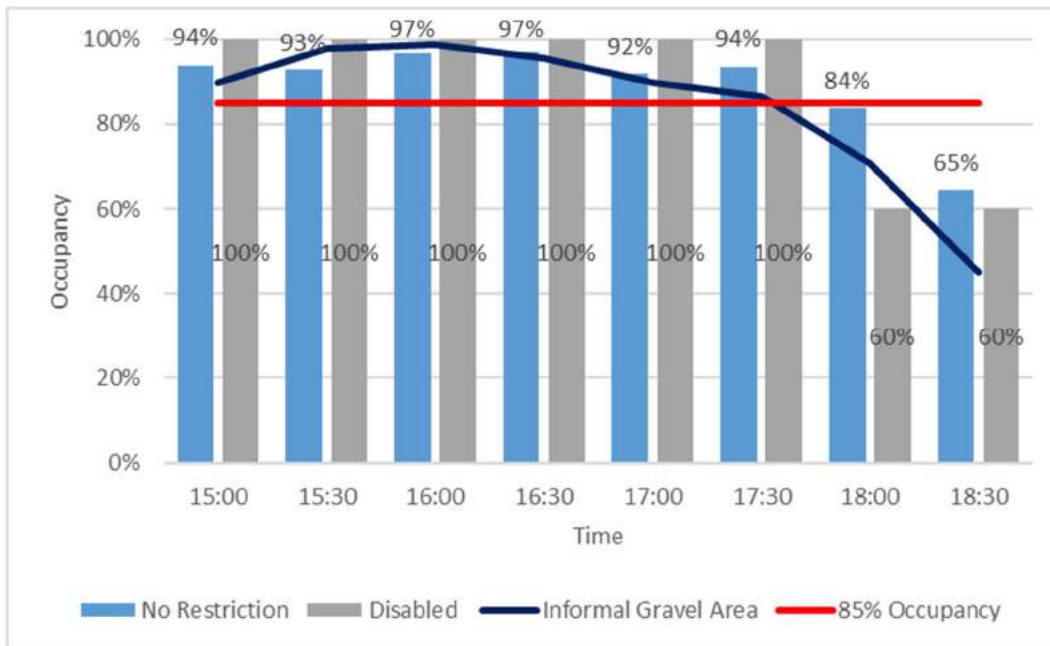
The occupancy survey results of the off-street carpark on Tuesday 27th March 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Figure 80 and Figure 81.

Figure 80 Waurm Ponds Station off-street car parking occupancy – morning peak period (6:00am to 9:30am)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

Figure 81 Waurm Ponds Station off-street car parking occupancy – evening peak period (3:00pm to 7:00pm)



Note: It is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas).

The following can be noted from Figure 80 and Figure 81.:

- 76% (212 of the 279-space occupied, with 67 spaces available) of parking spaces were occupied at the end of the morning peak period off-street car parking occupancy survey.
- By the commencement of the evening peak occupancy survey 94% of available parking spaces were occupied, with only 17 spaces available.
- Disabled parking provision was fully occupied between 15:00 to 17:30.
- The informal gravel area was being utilised for parking before the formal car parking area was close to capacity, most likely due to this area being more prominent to drivers accessing the area from the east and parking in the nearest available spaces. The gravel parking area was 89% fully at 9:00 and 16:00 during the undertaken surveys.

Table 24 provides a summary of the supply and demand of parking spaces for the off-street carpark at Waurm Ponds Station.

Table 24 Overview of Supply and Demand of off-street carparking spaces at Waurm Ponds Station

Parking Restriction	Supply	Tuesday 27 th March 2018			Monday 2 nd April 2018		
		Peak Demand	Occupancy	Time	Peak Demand	Occupancy	Time
No Restriction	279	271	97%	16:30	235	84%	14:00
Disabled	5	5	100%	15:00 – 17:30	2	40%	14:30
P2 minutes	4	2	50%	15:00	1	25%	10:30 - 11:00, 12:00 – 14:30
P5 minutes	3	3	100%	15:00	3	100%	11:30, 13:00, 14:00 – 14:30
Total formal car parking	291	277	95%	16:30	240	82%	14:00
Informal gravel car parking area	89	88	99%	9:00, 16:00	36	40%	12:00
Total car parking	380	362	95%	16:00	269	71%	13:00

It can be noted from Table 24 that the formal carpark at Waurm Ponds Station was surveyed to be operating at a maximum of 95%, with the informal gravel parking area being at 100%.

1.8.2 Car parking user observations

Surveys showed that all users of the Waurm Ponds Station off-street car park did so to use the station.

1.8.3 Bicycle parking

Waurm Ponds Station has capacity for a total of 30 bicycles split between spirals (9) and a parkiteer cage which provides 6 loops and 15 hanging spaces for bicycles.

Bicycle parking occupancy survey results on Tuesday 5th June 2018 in the morning (6:00 am to 9:30 am) and evening (3:00 pm to 7:00 pm) peak periods are shown in Table 25 and Table 26.

Table 25 Waurm Ponds Station – Supply and demand bicycle parking, AM peak

Bicycle parking		Supply	Morning surveys				
			6:00	7:00	8:00	9:00	9:30
Formal bicycle parking	Spirals	9	2	2	3	4	4
	Parkiteer Cage	Loops	6	0	0	1	1
		Hanging	15	3	4	6	7
	Total		30	3	4	6	7
% Occupancy			10%	13%	20%	23%	23%
Informal bicycle parking			0	0	0	0	0

Table 26 Waurm Ponds Station – Supply and demand bicycle parking, PM peak

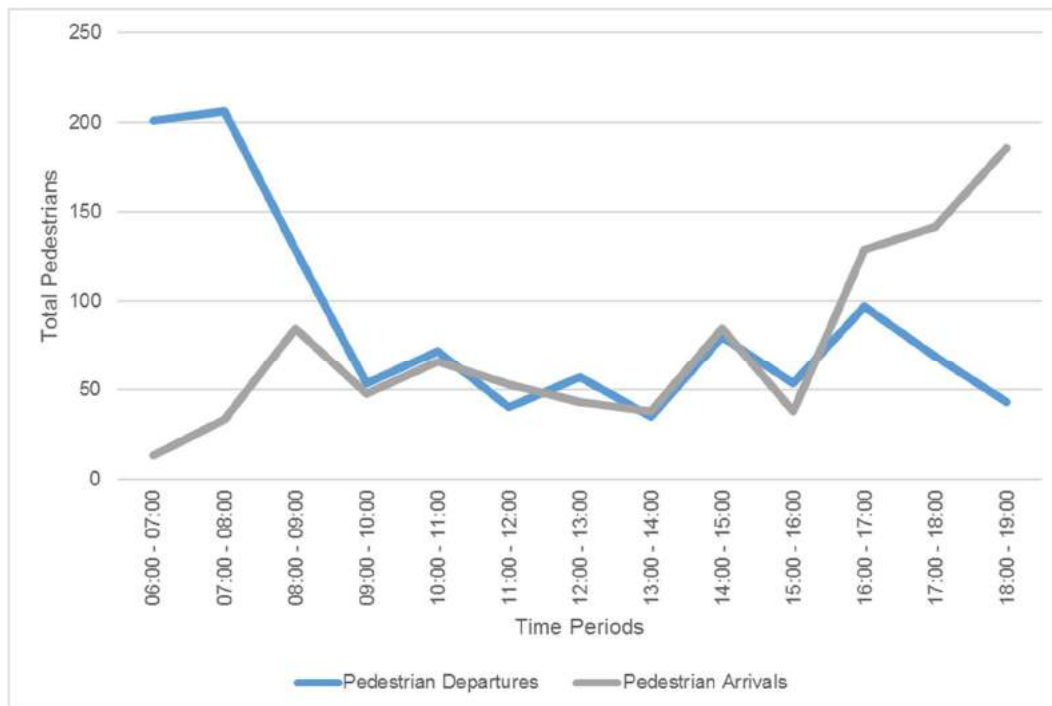
Bicycle parking		Supply	Evening surveys				
			15:00	16:00	17:00	18:00	19:00
Formal bicycle parking	Spirals	9	4	5	5	3	3
	Parkiteer Cage	Loops	6	1	1	1	1
		Hanging	15	2	2	2	0
	Total	30	7	8	8	4	4
% Occupancy			23%	27%	27%	13%	13%
Informal bicycle parking		0	0	0	0	0	0

As shown from Table 25 and Table 26, there is sufficient bicycle parking capacity at Waurm Ponds Station to meet current demand, with a peak bicycle parking occupancy of 27 percent.

1.8.4 Station gate volumes

The pedestrian arrivals and departures at Waurm Ponds Station were surveyed on Thursday 19th April 2018 from 6:00 am to 7:00 pm (13-hours). The pedestrian flow profile over the surveyed period is shown in Figure 82.

Figure 82 Waurm Ponds Station – pedestrian arrival and departures, Thursday 19th April 2018, 6:00 am to 7:00pm (13 hours)



The following can be noted from Figure 82:

- A total of 2,096 pedestrians travelled via Waurm Ponds Station over the total survey period.
- A total of 239 pedestrians (206 departing and 33 arriving) were recorded during the morning peak period between 7:00 and 8:00.
- A total of 226 pedestrians (97 departing and 129 arriving) were recorded during the evening peak period between 16:00 and 17:00.

1.8.5 Questionnaire survey findings

The questionnaire surveys at Waurn Ponds Station received responses from 116 commuters in the AM period and 86 in the PM period.

1.8.5.1 Demographics

Survey respondents were:

- Primarily between the ages of 30-49 years old at 46%, the second largest age group were between 18-29 at 39%.
- 53% male and 47% females in both the morning and evening survey periods.
- Split between full time (50%) and part time (49%) workers in the morning survey period. 58% of respondent’s part time workers in the evening survey period, with 31% full time workers.
- Primarily travelling for work purposes in the morning period at 74%, with 22% travelling for education purposes. In the evening peak period 55% of respondents were travelling for education purposes, with 36% due to work.

1.8.5.2 Mode share

The mode choice by the survey respondents on how they travelled to Waurn Ponds Station is shown in Figure 83. The reason of selection of this travel mode is shown in Figure 84 and Figure 85 for the morning and evening surveyed periods respectively.

Figure 83 Waurn Ponds Station – commuter modes

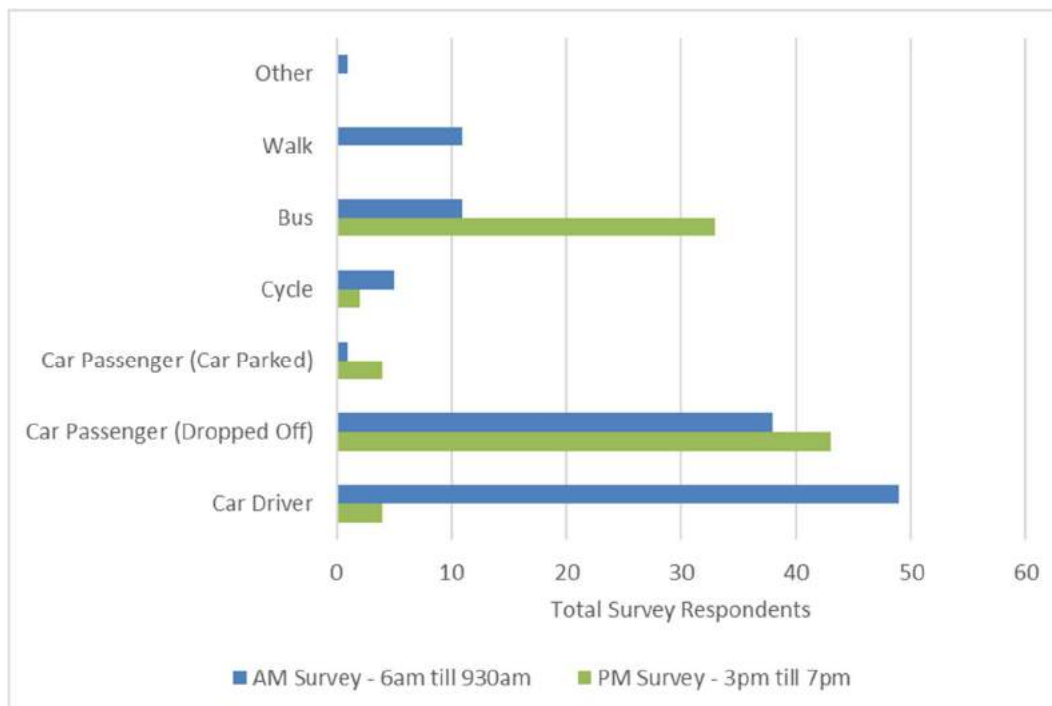


Figure 84 Waurn Ponds Station – commuter mode choice – morning peak

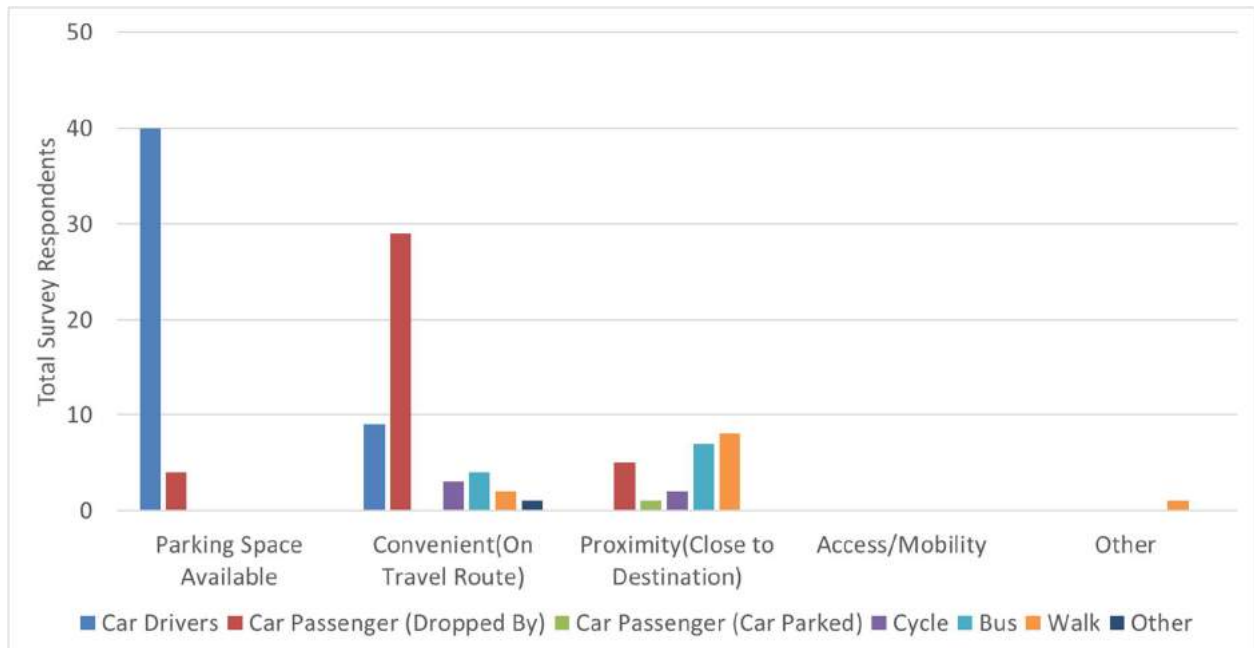
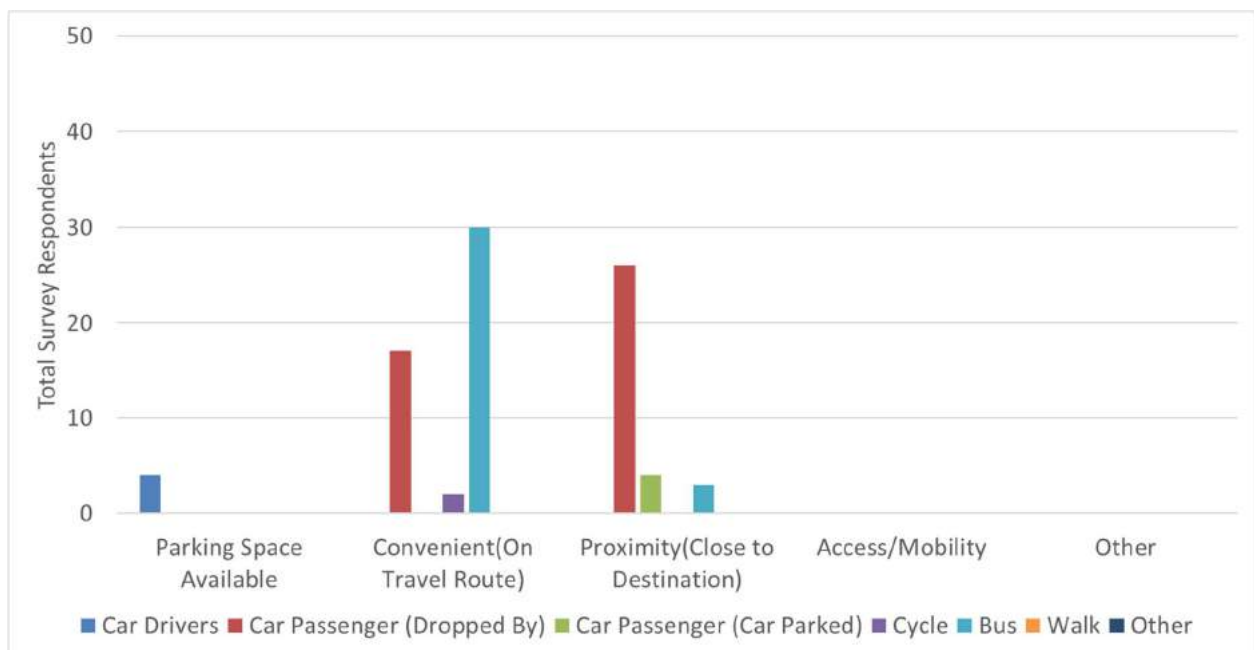


Figure 85 Waurn Ponds Station – commuter mode choice – evening peak



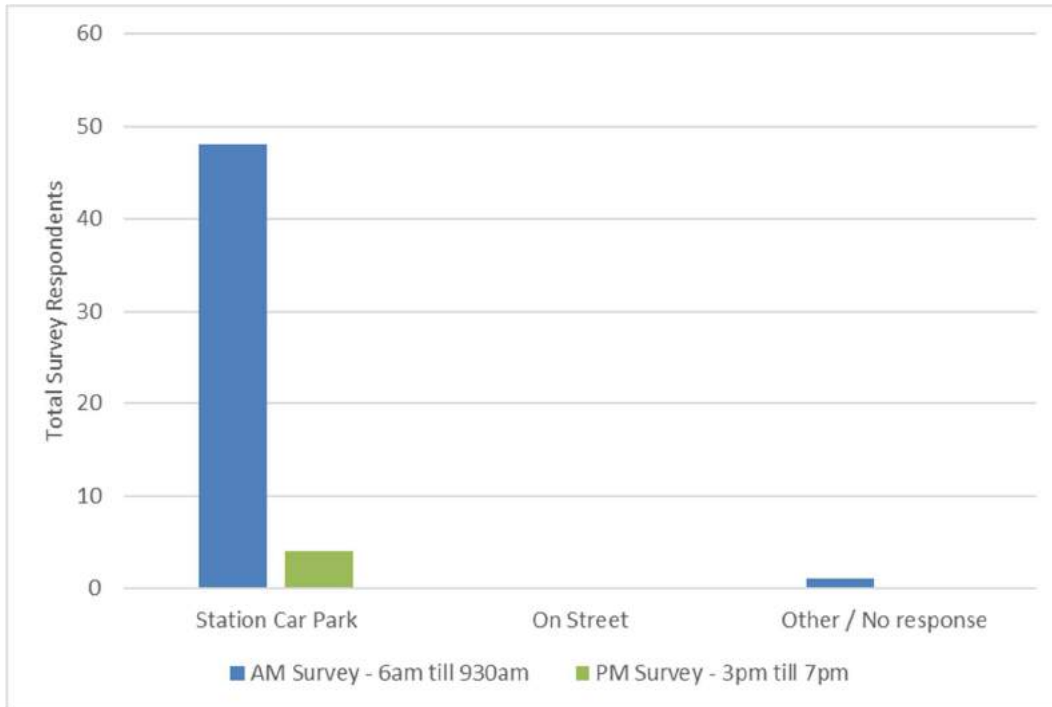
The following can be noted from the Waurn Ponds Station travel mode selection:

- 76% of commuter’s travel to Waurn Ponds Station by car in the surveyed morning period with 42% being car driver, 33% being dropped off and 1% as a car passenger (car parked). With the main reasoning behind car use being the availability of car parking.
- 60% of commuter’s travel to Waurn Ponds Station by car in the surveyed morning period with 5% being car driver, 50% being dropped off and 5% as a car passenger (car parked). 38% of commuters used the bus in the evening survey period (compared with only 9% in the morning). The car drops off were due to the drivers travel route and proximity to the station. Bus usage was due to convenience of the bus route to the station..

1.8.5.3 Commuter parking habits

The parking habits of commuters to Waurm Ponds Station is provided in Figure 86. As shown all those who responded parked in the provided off-street station car park.

Figure 86 Waurm Ponds Station – Commuter parking location

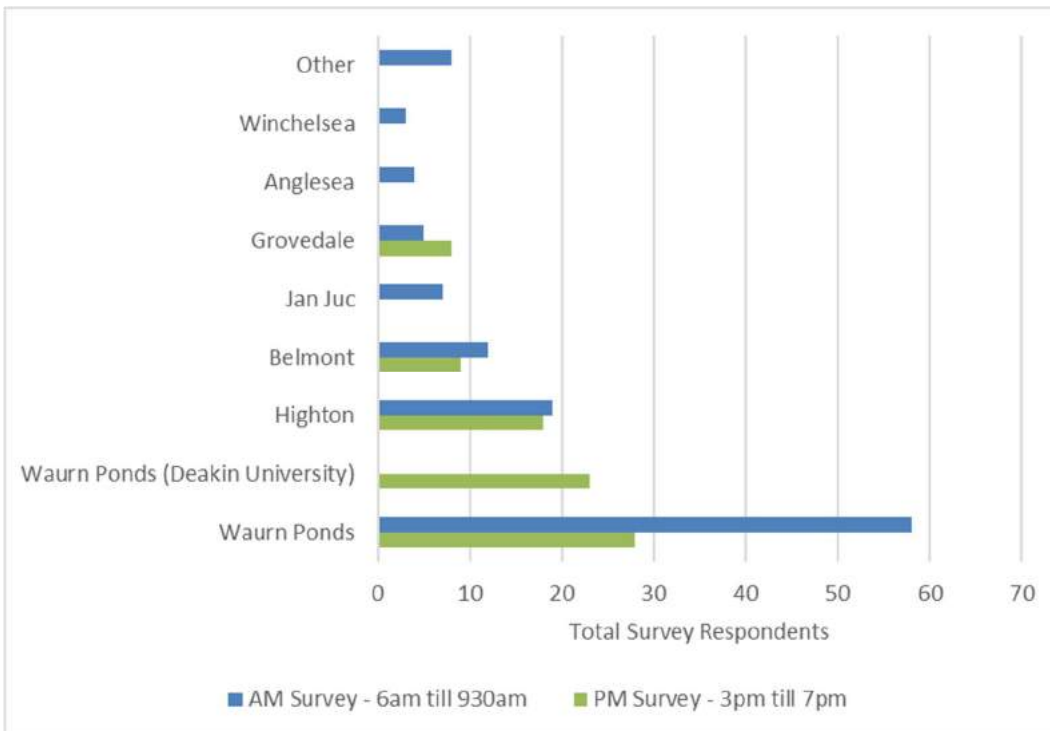


1.8.5.4 Waurm Ponds Station commuter travel findings

The following figures show the Lara Station commuter travel origins/destination, travel purpose and times:

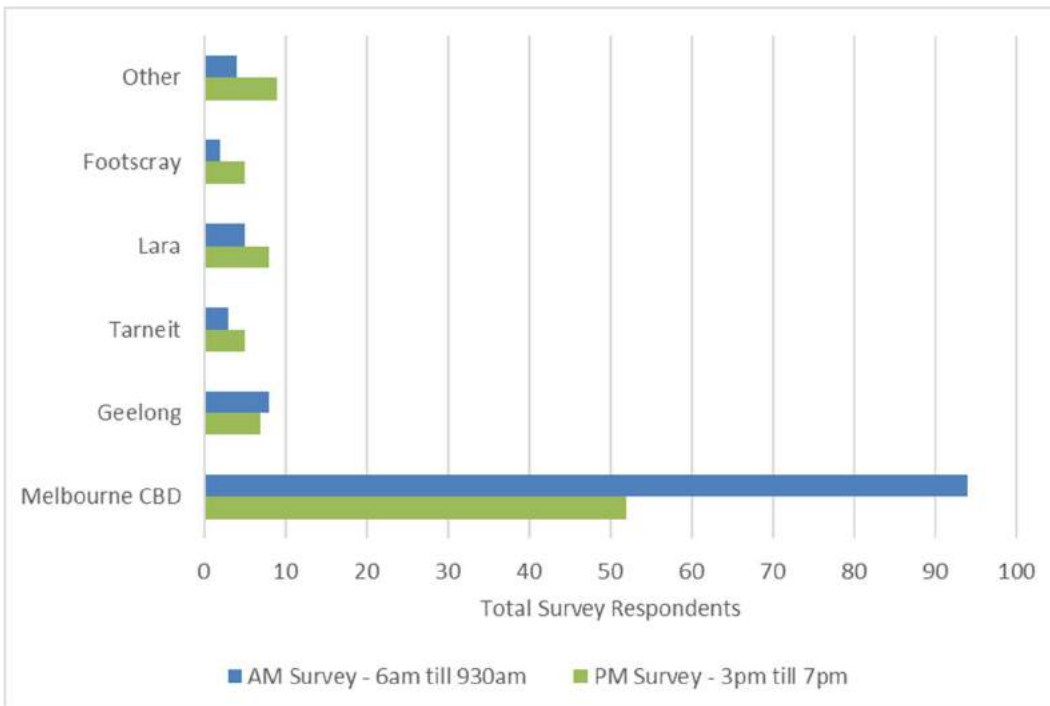
- The surveyed commuter origins and destinations for the AM and PM peak periods are shown in Figure 87 and Figure 88.
- The respondents travel purposes are surmised in Figure 89.
- The respondents indicative travel times are outlined in Figure 90.

Figure 87 Waurn Ponds commuter origins – AM and PM survey periods



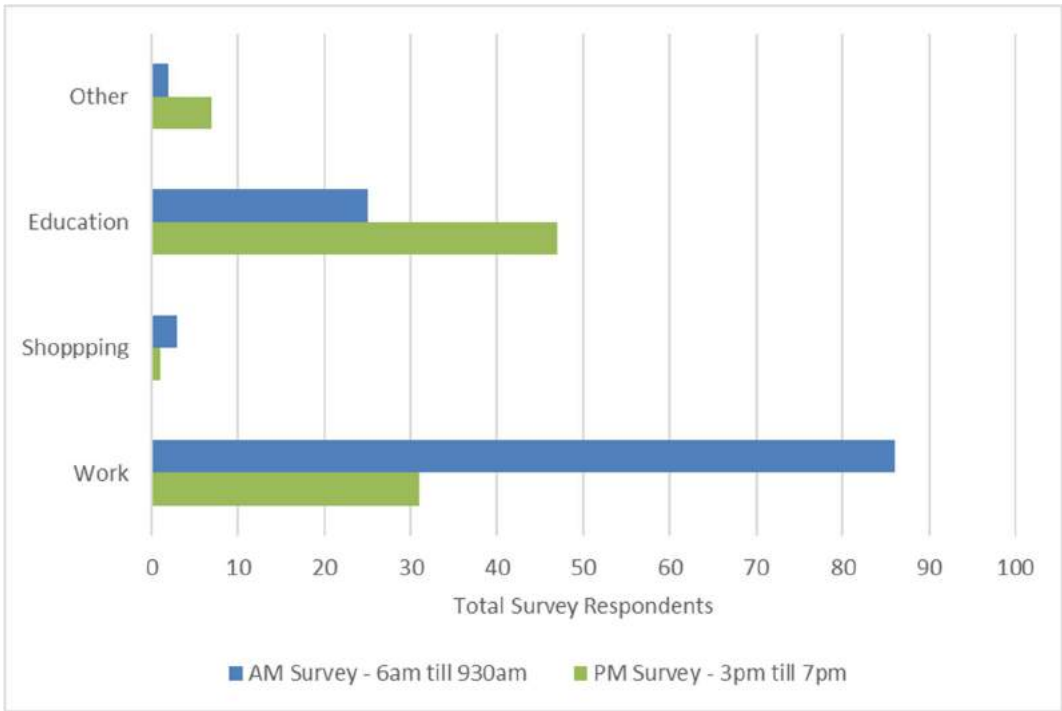
As shown most commuters originate from Waurn Ponds in both the morning and evening survey periods. With the evening responses disaggregated between those from Waurn Ponds and the local Deakin University where survey responses stated.

Figure 88 Waurn Ponds commuter destinations – AM and PM survey periods



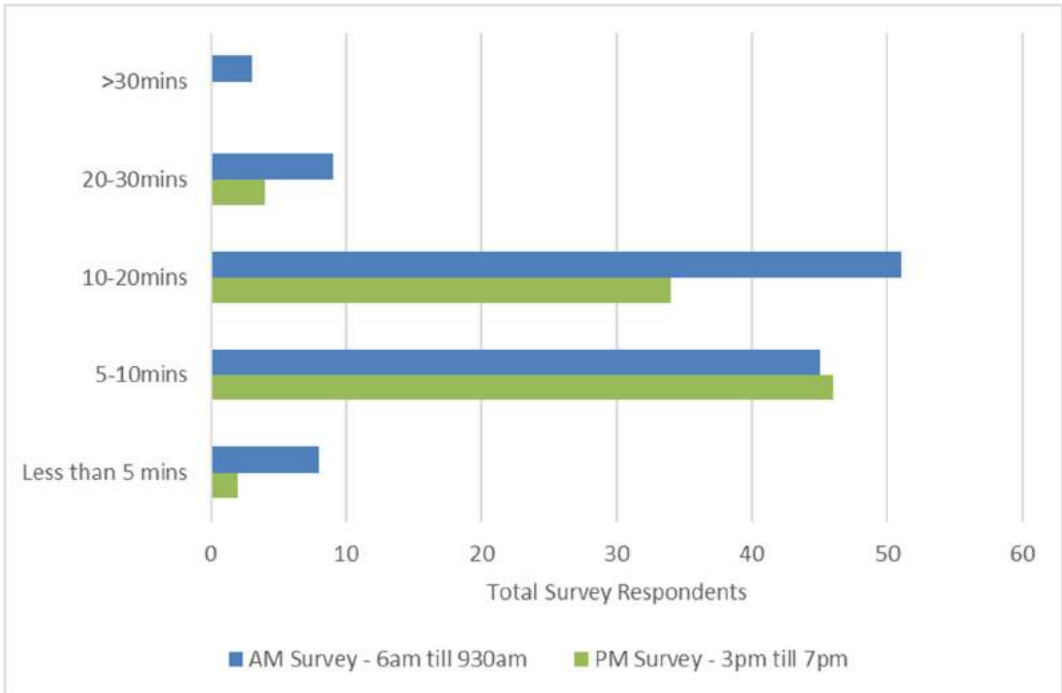
As shown the majority of commuters are travelling to Melbourne CBD during both the morning and evening survey periods.

Figure 89 Waurn Ponds ccommuter travel purpose



As expected most commuters are travelling to work (74%) during the morning survey period, with 22% of respondents doing so for education purposes. In the evening peak period the majority are travelling for education reasons (55%), with the majority of other responders doing so for work (36%) purposes.

Figure 90 Waurn Ponds commuter travel times

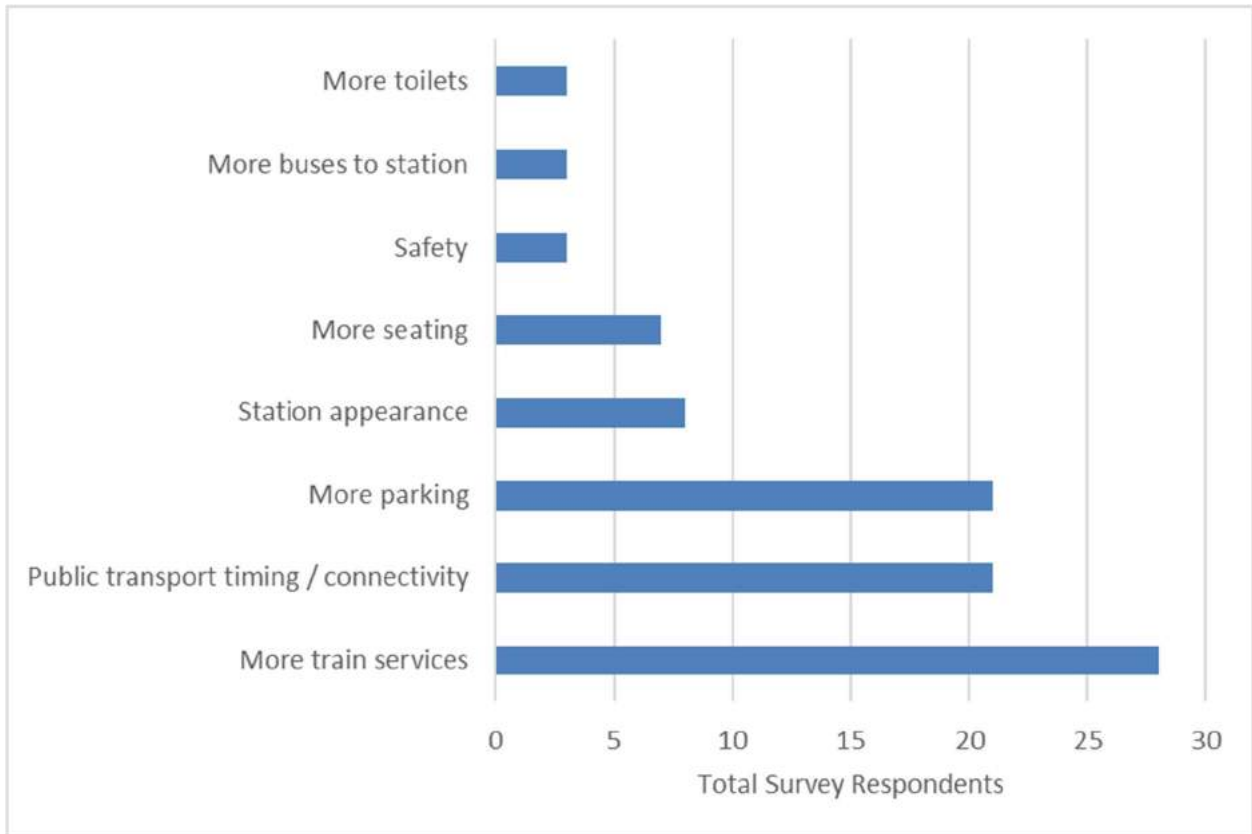


Commuters were asked how long their respective journeys took from their point of origin. 90% and 95% of respondents travelled less than 20 minutes in the morning and evening survey periods respectively.

1.8.5.5 Waurm Ponds Station – suggested improvements

Waurm Ponds Station commuters were asked what suggested improvements they would make to either the Station or transport links. A summary of the most frequent responses is provided in Figure 91.

Figure 91 Waurm Ponds Station – suggested improvements



The following can be noted from the above suggested improvements to either Waurm Ponds Station or local links. These have been grouped into hard (physical) and soft (operational) measures, with survey response rate based on all those surveyed:

- In terms of 'hard' measures, the following was noted:
 - 22% of respondents wanted more car parking at Waurm Ponds Station
 - 9% of respondents would improve the station appearance.
 - 7% requested more seating.
 - 3% requested better safety.
 - 3% requested more toilets.
- In terms of 'soft' measures, the following was noted:
 - 30% of respondents requested for there to be more trains.
 - 22% suggested better public transport timing and connectivity.
 - 3% suggested more buses to and from the station.

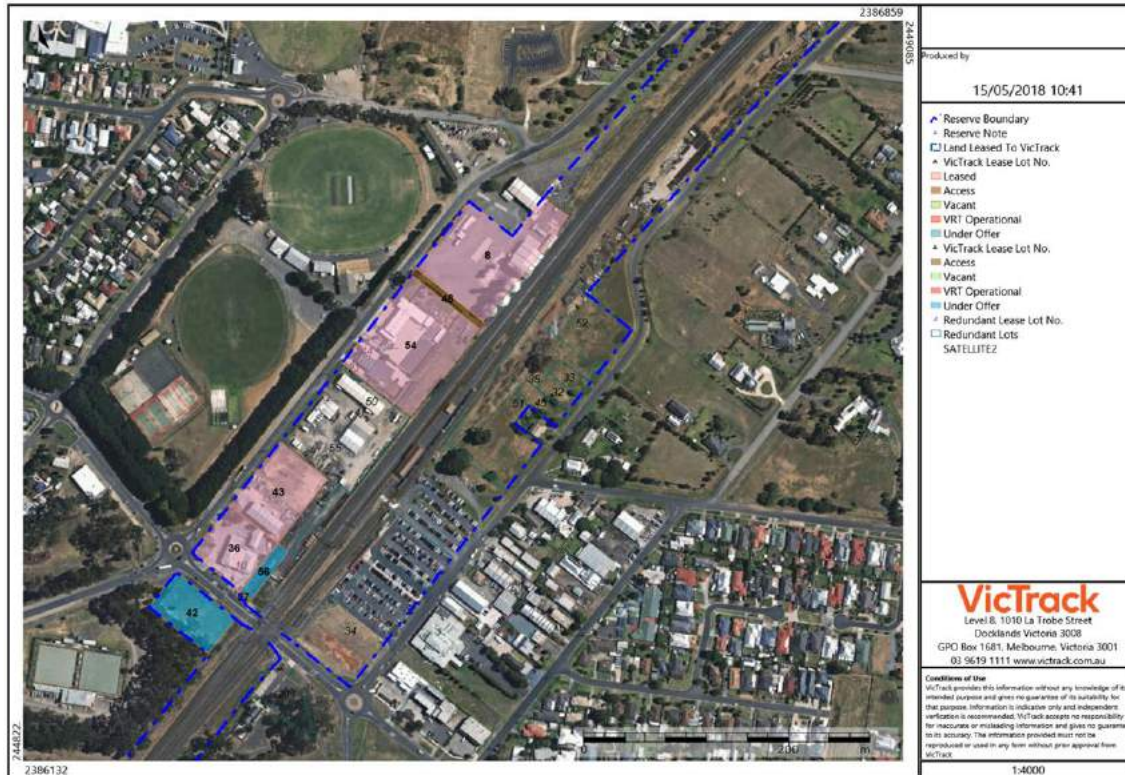
Appendix C

Planning Zoning and Boundary Maps

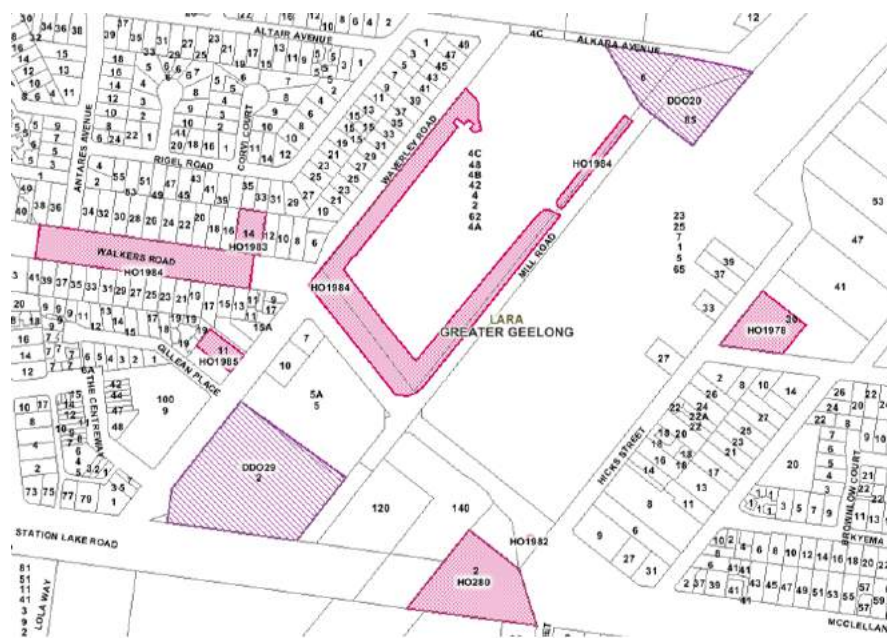
Appendix C: Planning, Zoning and Boundary Maps

1.1 Lara Station

VicTrack land boundary – Lara Station

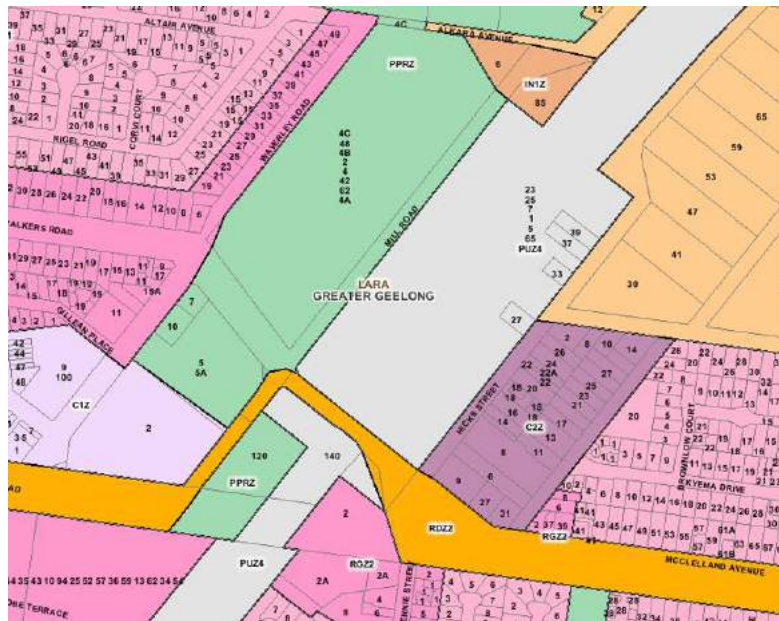


Planning overlays – Lara Station



- Heritage Overlays:**
- HO1978: House and Dairy outbuilding
 - HO280: Corio Shire Hall (former)
 - HO1984: Avenues of Honour, Cypressess, Memorial Gates & Fencing
- Design and Development Overlays:**
- DDO20
 - DDO29

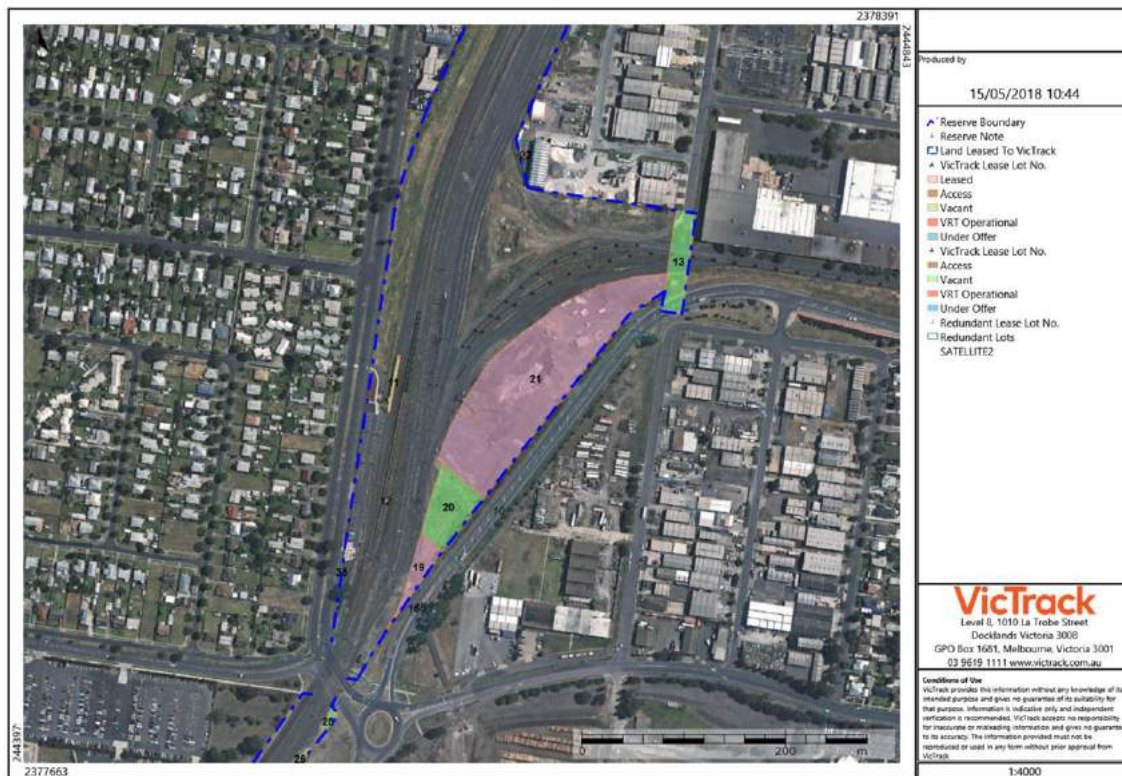
Zoning – Lara Station



- Zones:
- PUZ4: Public Use Transport
 - C2Z: Commercial 2
 - PPRZ: Public Park & Recreation
 - IN1Z: Industrial 1
 - RDZ2: Road Category
 - RLZ: Rural Living

1.2 North Shore Station

VicTrack land boundary – North Shore Station



Planning overlays – North Shore Station



DDO20

Zoning – North Shore Station



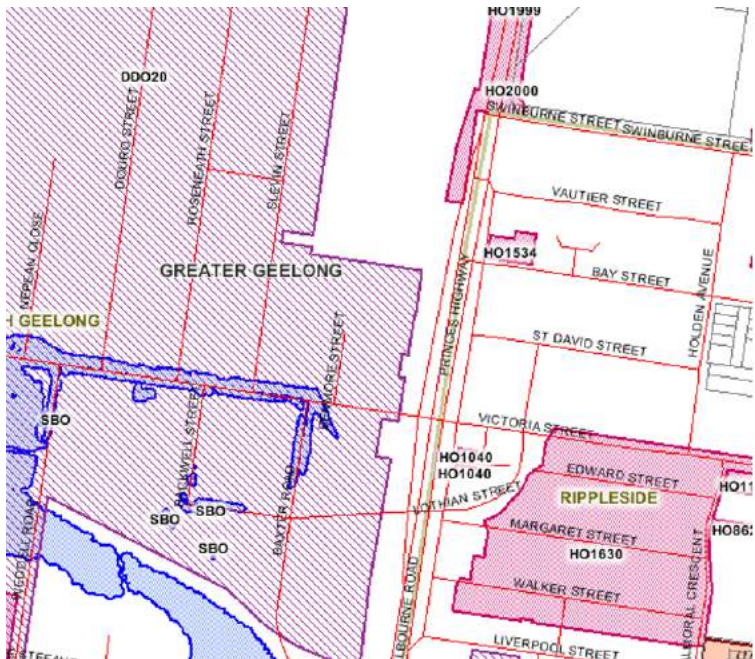
- Zones :
- PUZ4
 - GRZ1
 - RDZ1
 - INZ2
 - IN1Z

1.3 North Geelong Station

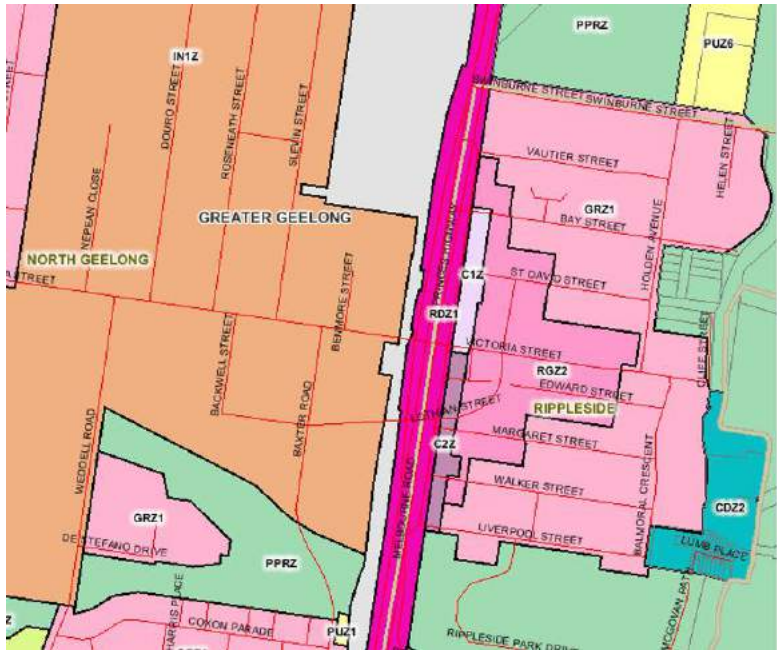
VicTrack land boundary – North Geelong Station



Planning overlays – North Geelong Station



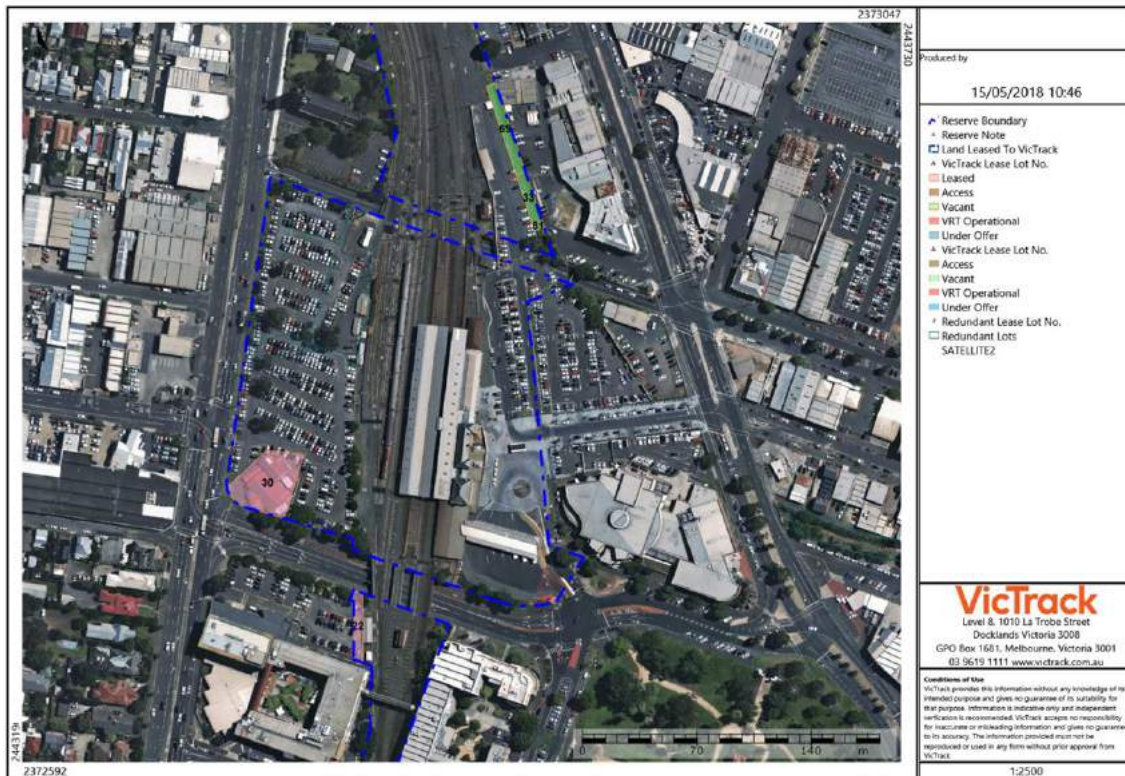
Zoning – North Geelong Station



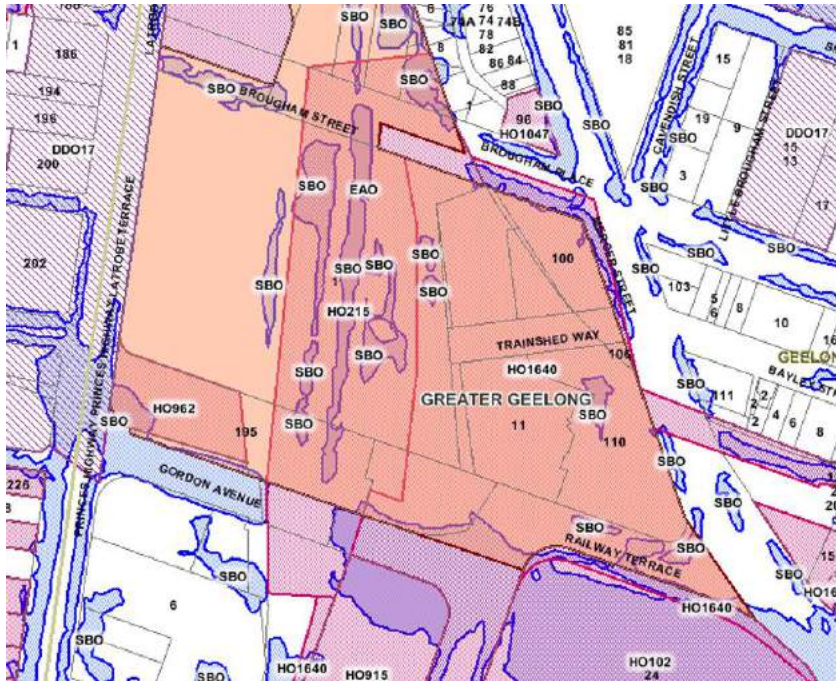
- Zones :
- PUZ4: Public Use - Transport
 - IN1Z: Industrial 1
 - RDZ1: Road – Category 1

1.4 Geelong Station

VicTrack land boundary – Geelong Station



Planning overlays – Geelong Station

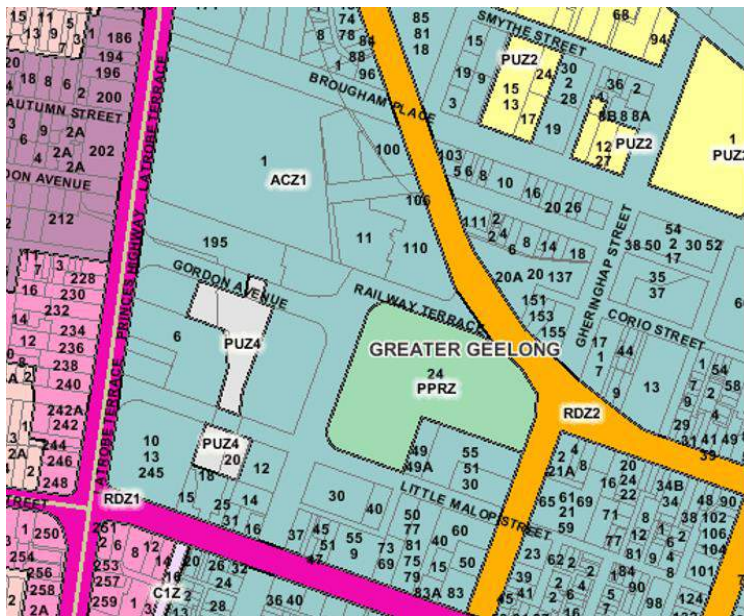


Heritage Overlays:

- HO962
- HO215
- HO1640

SBO: Special Building Overlay
EAO: Environmental Audit Overlay

Zoning – Geelong Station



Zones :

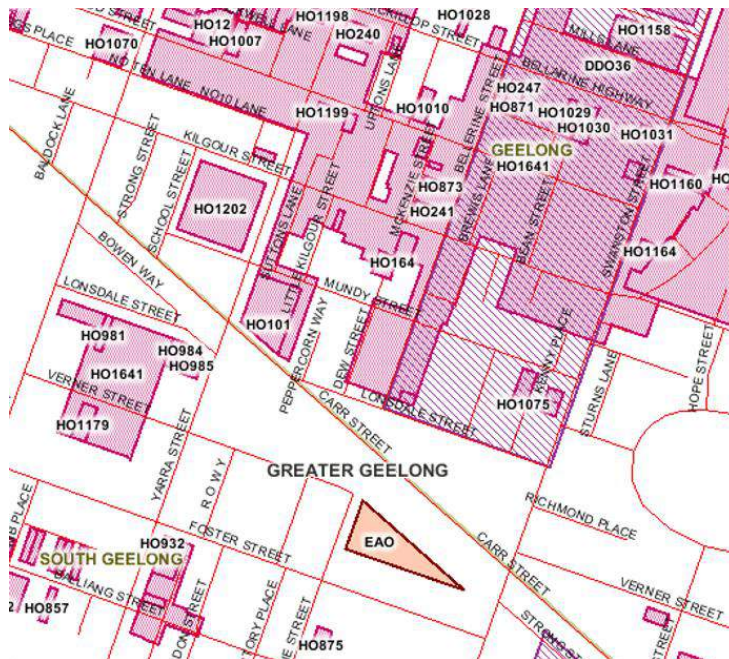
- ACZ1: Activity Centre
- RDZ1: Road – Category 1
- RDZ2: Road – Category 2

1.5 South Geelong Station

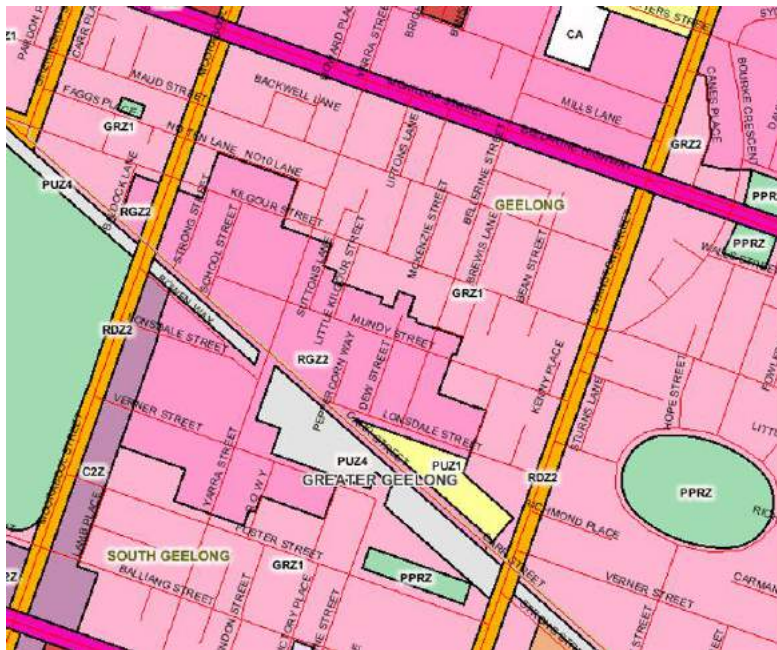
VicTrack land boundary – South Geelong Station



Planning overlays – South Geelong Station



Zoning – South Geelong Station



- PUZ4
- GRZ1
- PPRZ
- PUZ1
- RGZ2
- RDZ2

1.6 Marshall Station

VicTrack land boundary – Marshall Station



Planning overlays – Marshall Station



Zoning – Marshall Station

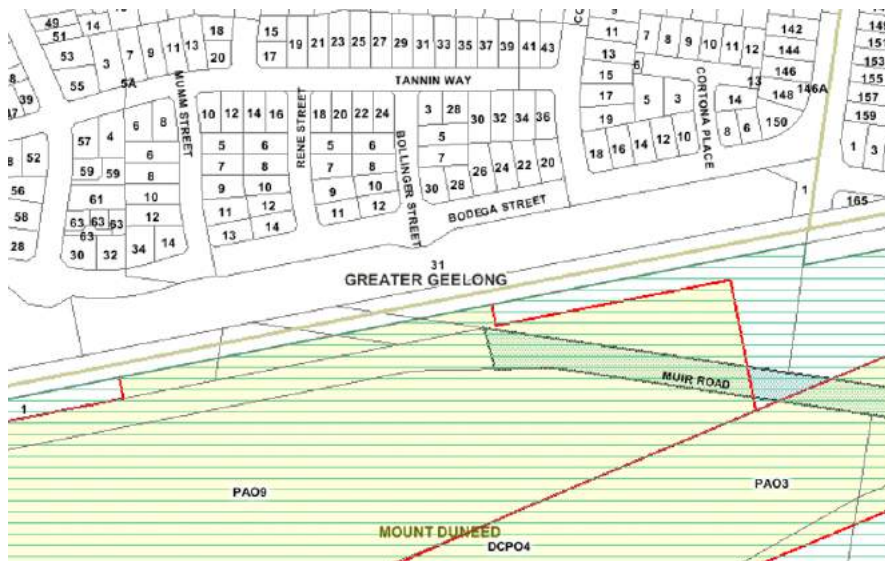


1.7 Waurn Ponds Station

VicTrack land boundary – Waurn Ponds Station



Planning overlays – Waurn Ponds Station

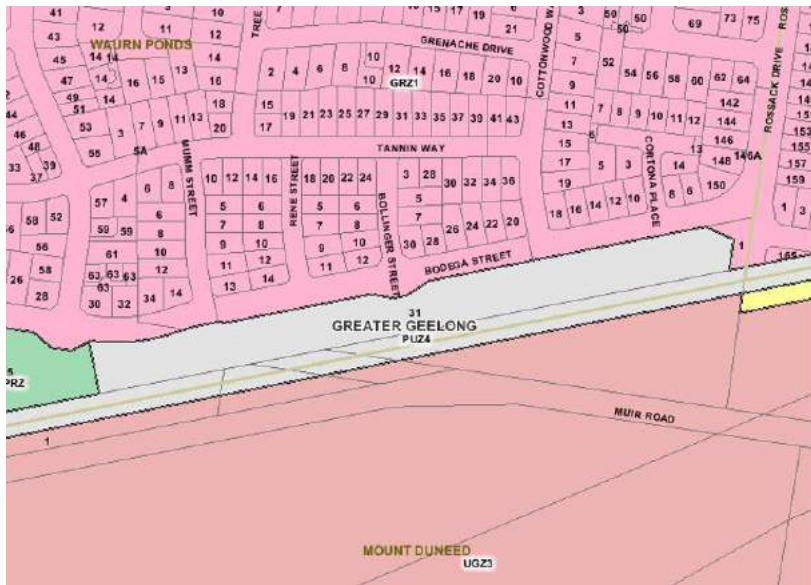


No immediate Heritage Overlays

- PA09: Public Acquisition
- PA03: Public Acquisition
- DCPO4: Development Contributions Plan
- VPO1: Vegetation Protection

Flooding overlay to the south of the PA03

Zoning – Waurn Ponds Station



- Zones:
- UGZ3
 - PPRZ
 - GRZ1
 - PUZ4

Appendix D

Comparison of Station Usage

Appendix D – Comparison of Station Usage Patterns

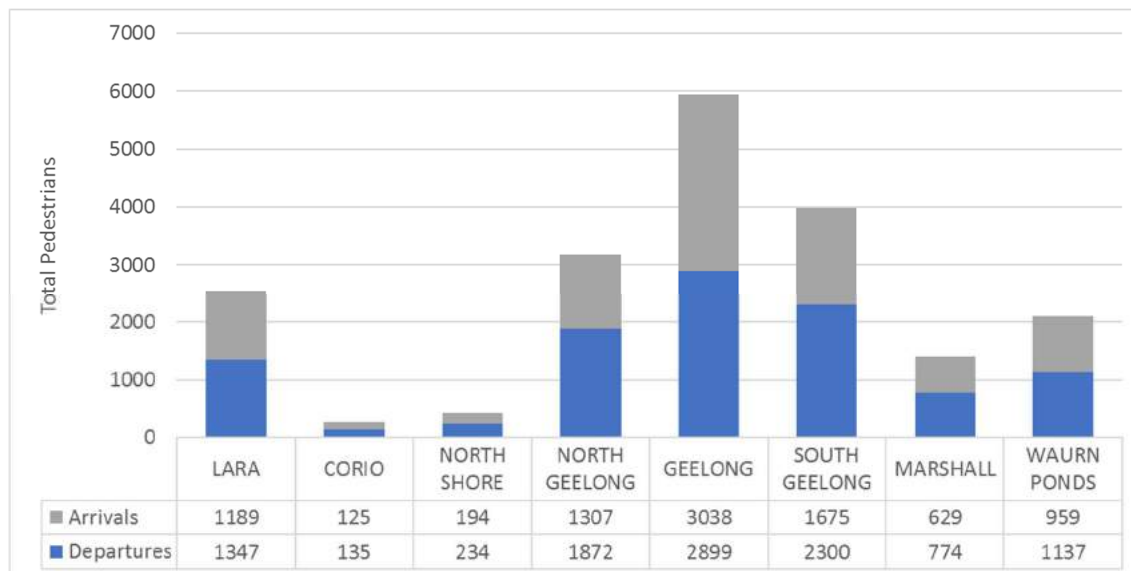
This chapter gives an understanding at a corridor level context to the commuter usage findings from the surveys outlined previously in this report.

1.1 Station usage

The usage of the railway stations in the Geelong corridor are influenced by their respective locations to key land uses. A summary of the station gate surveys is provided in the following figures:

- **Figure 1** – total 13-hour survey time period, 6am till 7pm.
- **Figure 2** – morning peak survey time period, 6am till 930am.
- **Figure 3** – evening peak survey time period, 3pm till 7pm.

Figure 1 Station gate surveys – 13h-hour time period, 6am till 7pm



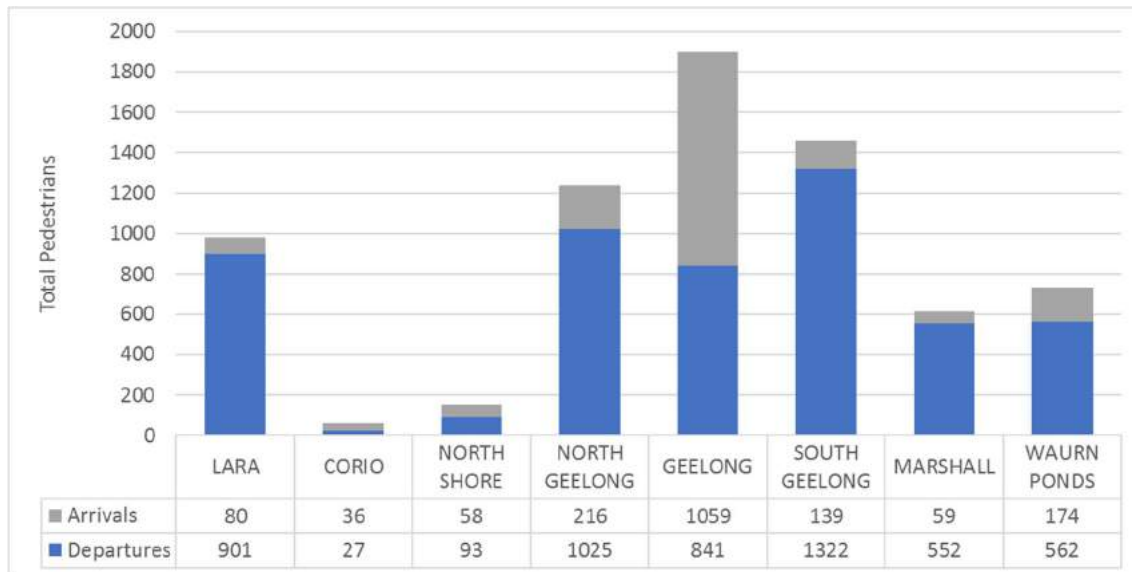
As shown the stations in closer proximity to key land use activity are the busiest along the Geelong railway corridor. Geelong station has the highest patronage with a total of 5,937 two-way trips over the 13-hr survey time (6am till 7pm), with South Geelong (3,975 two-way trips) and North Geelong (3,179 two-way trips) also showing high levels of activity in comparison to the rest of the stations along the corridor.

Lara (2,536 two-way trips) and Waurn Ponds (2,096 two-way trips) stations, although located on the outskirts of the corridor, are located in good proximity to residential land uses, with Waurn Ponds also providing a link to Deakin University.

Marshall station (1,403 two-way trips) is located near residential land uses with some employment land uses located approximately 1km west of the station.

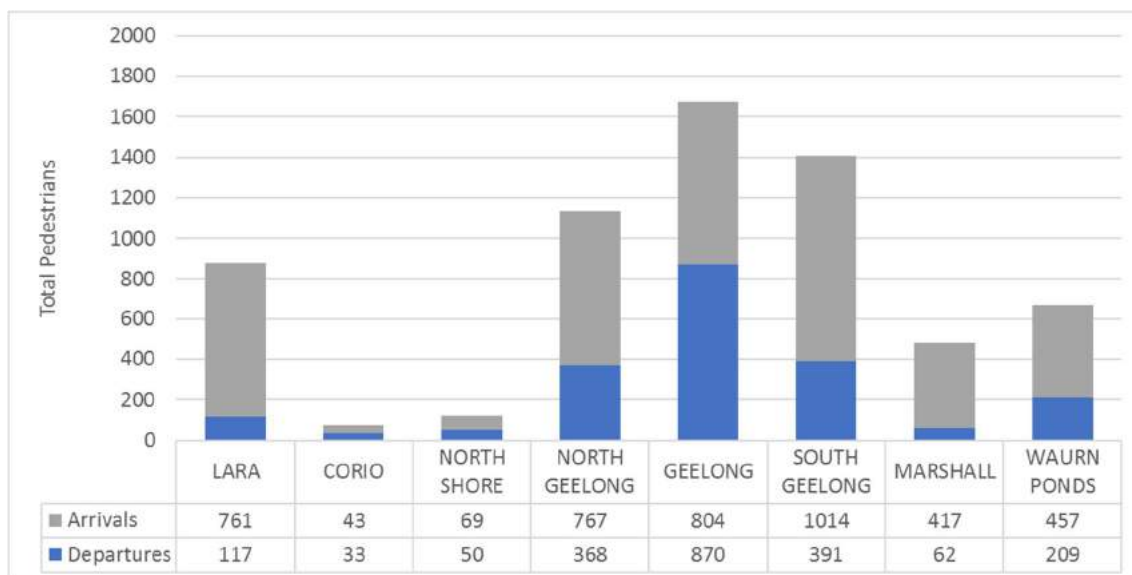
As North Shore (428 two-way trips) and Corio (260 two-way trips) stations are located near the industrial / port areas of Geelong they have low levels of patronage usage.

Figure 2 Station gate surveys – morning peak survey time period, 6am till 930am



As shown above during the morning peak (6am till 930am) most commuters are departing from the Geelong study corridor stations, with only Geelong Station differing from this trend. Geelong Station has slightly more arrivals than departures during the morning which is influenced by the local employment, retail and education land uses in the centre of Geelong.

Figure 3 Station gate surveys – evening peak survey time period, 3pm till 7pm



As shown above during the evening peak (3pm till 7pm) the inverse trend from the morning peak occurs across the Geelong study corridor stations, except for Geelong Station, that is the majority of commuters are arriving at the relative stations. Geelong Station has an almost equal proportion of arrivals and departures during this time period.

1.2 Trip purpose

Table 1 and Table 2 outline the trip purpose survey findings by station for the morning (6am till 930am) and evening (3pm till 7pm) surveyed time periods. The results are shown graphically over the study corridor in Figure 4 (morning) and Figure 5 (evening) for the respective time periods.

Overall the survey found that most commuters are travelling to and from work and educational purposes in the respective morning and evening survey periods, with those travelling for other reasons (likely recreational) increasing in the evening survey period.

Table 1 Trip purpose - morning survey period (6am till 930am)

Station	Trip Purpose - Totals					Trip Purpose - Percentage				
	Work	Shop	Education	Other	Total	Work	Shop	Education	Other	Total
Lara	53	0	22	5	80	66%	0%	28%	6%	100%
North Shore	27	0	5	5	37	73%	0%	14%	14%	100%
North Geelong	124	4	29	14	171	73%	2%	17%	8%	100%
Geelong	79	1	29	51	160	49%	1%	18%	32%	100%
South Geelong	95	2	27	35	159	60%	1%	17%	22%	100%
Marshall	36	6	16	14	72	50%	8%	22%	19%	100%
Waurnd Ponds	86	3	25	2	116	74%	3%	22%	2%	100%
Total	500	16	153	126	795					
Percent	63%	2%	19%	16%	100%	100%	100%	100%	100%	100%

Table 2 Trip purpose - evening survey period (3pm till 7pm)

Station	Trip Purpose - Totals					Trip Purpose - Percentage				
	Work	Shop	Education	Other	Total	Work	Shop	Education	Other	Total
Lara	14	5	10	32	61	23%	8%	16%	52%	100%
North Shore	11	0	1	12	24	46%	0%	4%	50%	100%
North Geelong	51	3	19	39	112	46%	3%	17%	35%	100%
Geelong	72	8	39	35	154	47%	5%	25%	23%	100%
South Geelong	30	2	17	32	81	37%	2%	21%	40%	100%
Marshall	9	4	3	16	32	28%	13%	9%	50%	100%
Waurnd Ponds	31	1	47	7	86	36%	1%	55%	8%	100%
Total	218	23	136	173	550					
Percent	40%	4%	25%	31%	100%	100%	100%	100%	100%	100%

Figure 4 Trip purpose – morning survey 6am till 930am responses

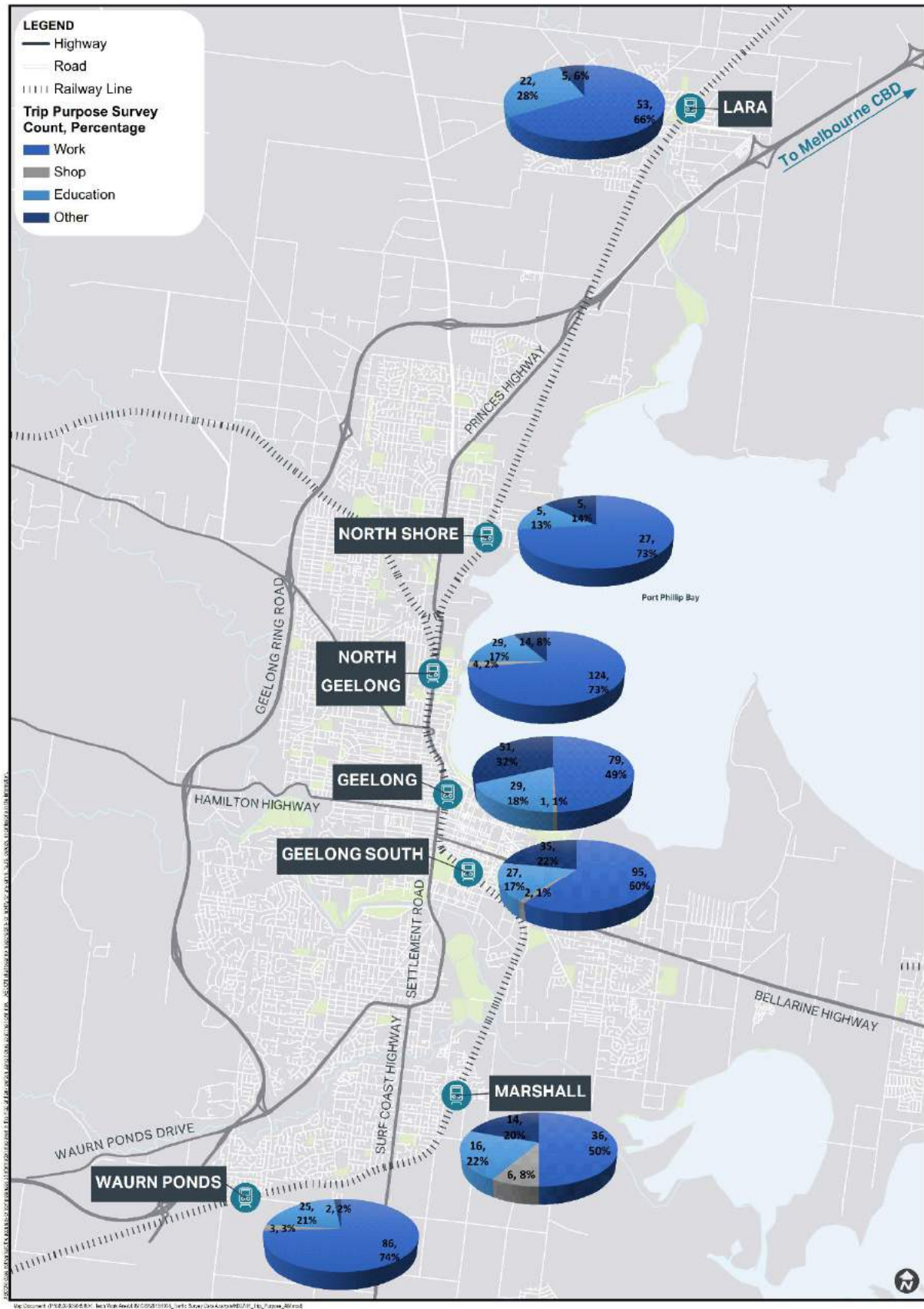
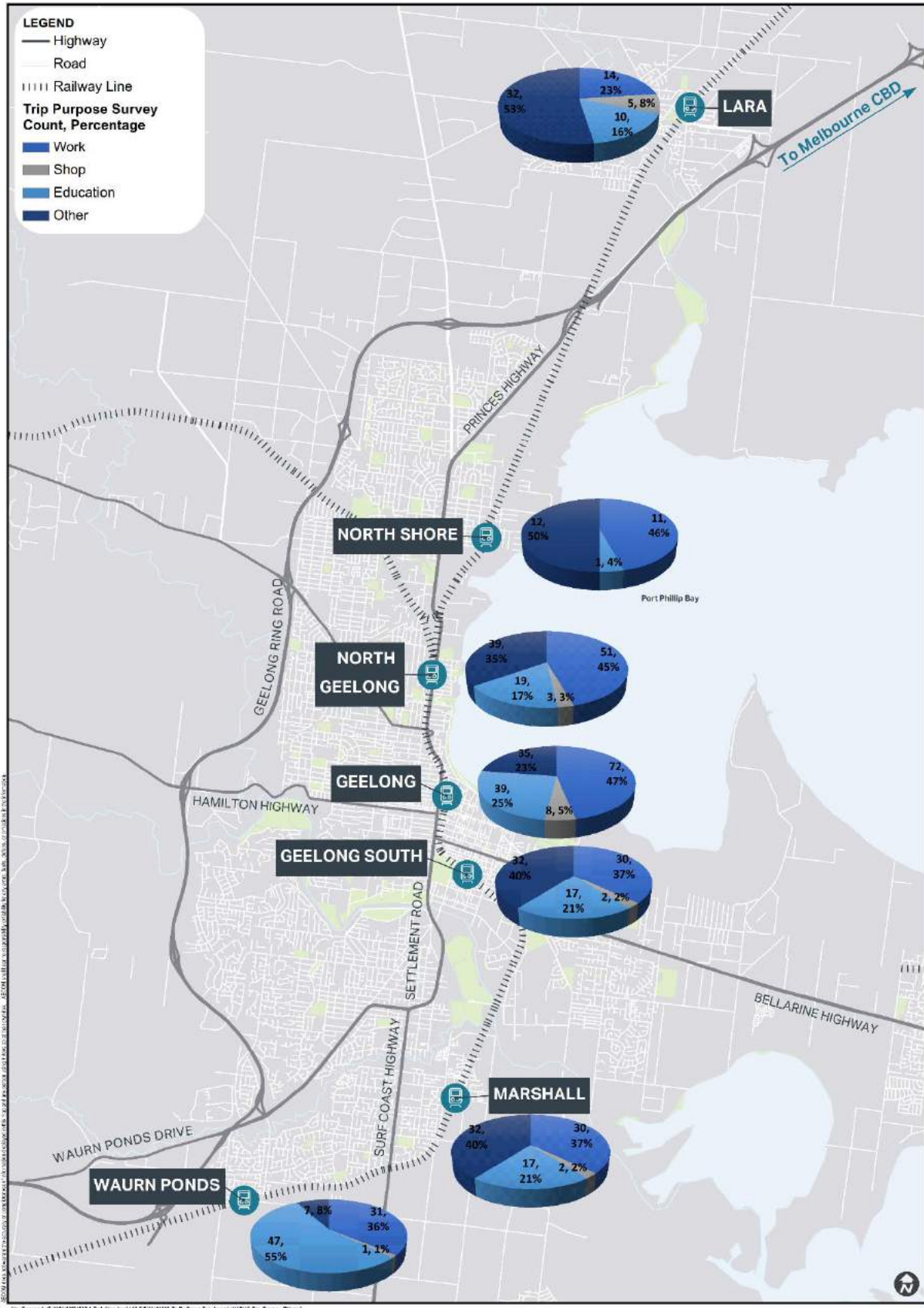


Figure 5 Trip purpose – evening survey 3pm till 7pm responses



1.3 Station mode shares

Table 3 provides a summary of the survey response with regards to mode of transport commuter used to their respective stations.

The mode share by transport for the morning and evening are provided graphically in Figure 6 and Figure 7 respectively.

Table 3 Station mode shares – morning and evening peak survey responses

Mode	Surveyed Stations - Mode Share - Morning Peak 6am till 930am - Total Responses						
	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurrn Ponds
Car Driver	42	13	104	57	77	39	49
Passenger (Dropped Off)	13	3	27	21	39	12	38
Car Passenger (Car Parked)	0	0	1	2	12	0	1
Cycle	5	1	5	2	6	1	5
Bus	9	3	13	63	7	5	11
Walk	7	17	20	17	19	14	11
Other	4	0	2	2	1	1	1
Totals	80	37	172	164	161	72	116
Mode	Surveyed Stations - Mode Share - Morning Peak 6am till 930am - Mode Share Percentage						
	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurrn Ponds
Car Driver	53%	35%	60%	35%	48%	54%	42%
Passenger (Dropped Off)	16%	8%	16%	13%	24%	17%	33%
Car Passenger (Car Parked)	0%	0%	1%	1%	7%	0%	1%
Cycle	6%	3%	3%	1%	4%	1%	4%
Bus	11%	8%	8%	38%	4%	7%	9%
Walk	9%	46%	12%	10%	12%	19%	9%
Other	5%	0%	1%	1%	1%	1%	1%
Totals	100%	100%	100%	100%	100%	100%	100%
Mode	Surveyed Stations - Mode Share - Evening Peak 3pm till 7pm - Total Responses						
	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurrn Ponds
Car Driver	19	7	23	37	19	13	4
Passenger (Dropped Off)	5	1	10	11	16	8	43
Car Passenger (Car Parked)	4	0	0	2	6	0	4
Cycle	3	3	4	1	1	1	2
Bus	5	8	52	88	34	6	33
Walk	17	5	21	17	2	4	0
Other	10	0	3	0	6	0	0
Totals	63	24	113	156	84	32	86
Mode	Surveyed Stations - Mode Share - Evening Peak 3pm till 7pm - Mode Share Percentage						
	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurrn Ponds
Car Driver	30%	29%	20%	24%	23%	41%	5%
Passenger (Dropped Off)	8%	4%	9%	7%	19%	25%	50%
Car Passenger (Car Parked)	6%	0%	0%	1%	7%	0%	5%
Cycle	5%	13%	4%	1%	1%	3%	2%
Bus	8%	33%	46%	56%	40%	19%	38%
Walk	27%	21%	19%	11%	2%	13%	0%
Other	16%	0%	3%	0%	7%	0%	0%
Totals	100%	100%	100%	100%	100%	100%	100%

Figure 6 Mode shares – morning survey 6am till 930am responses

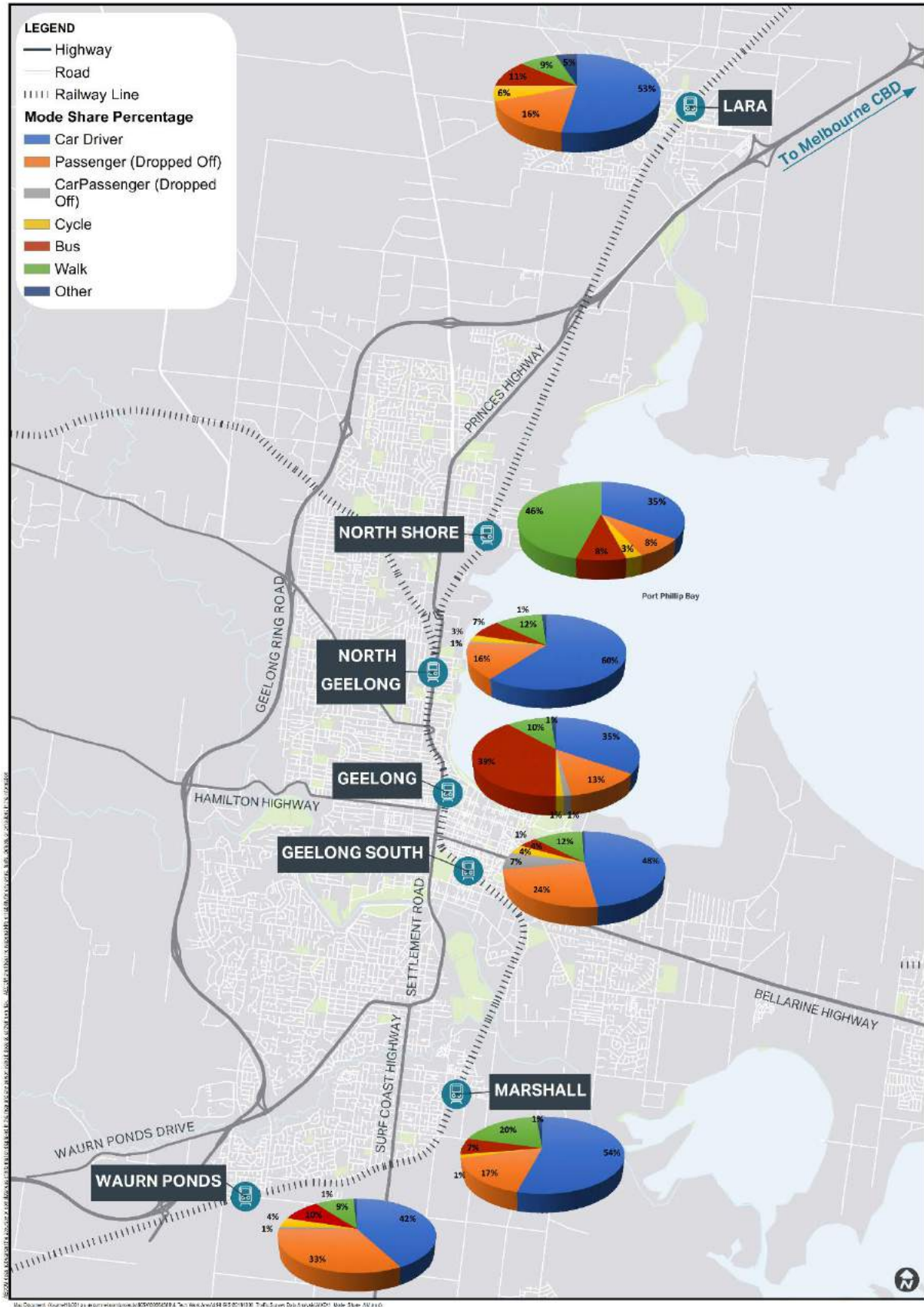
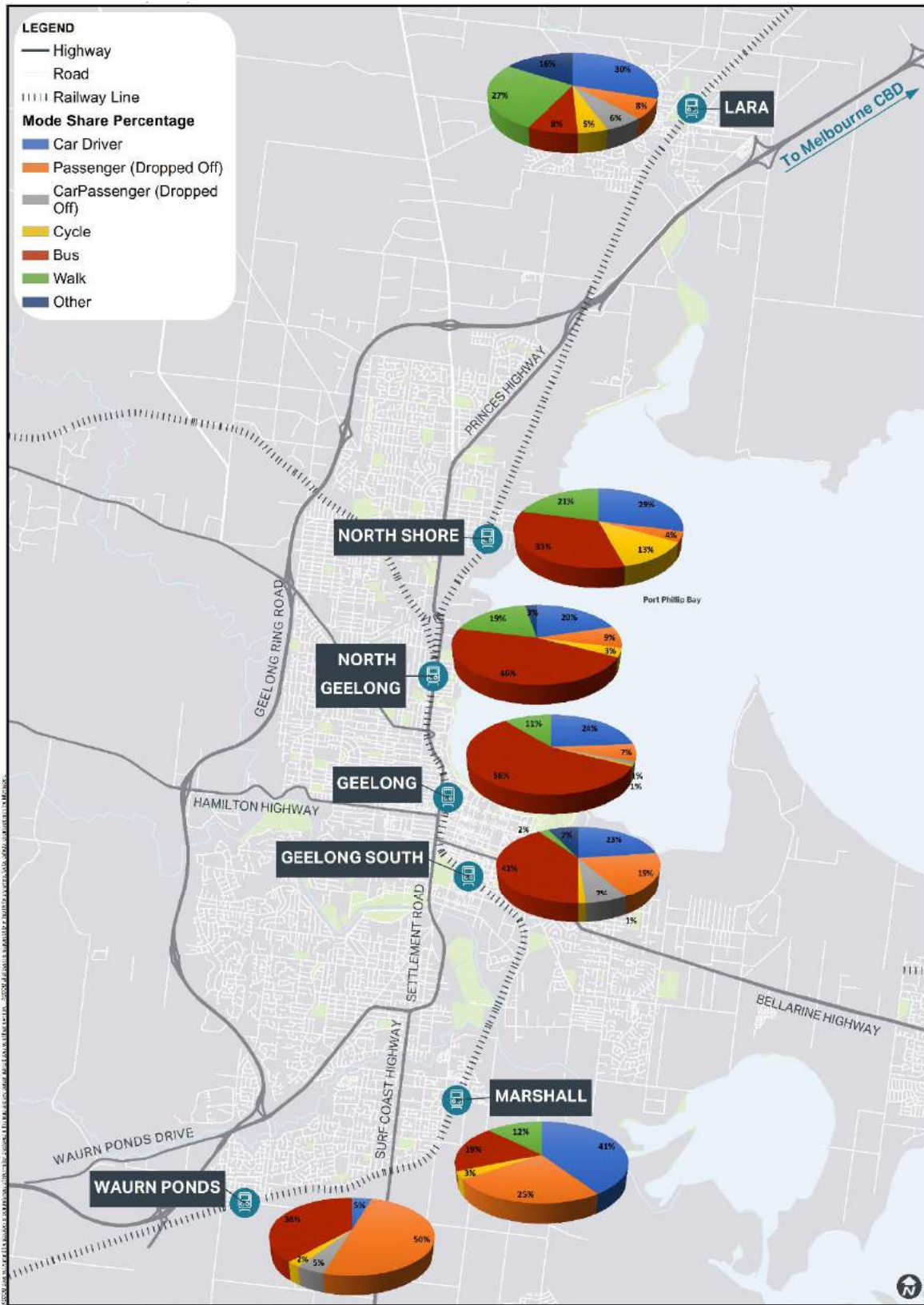


Figure 7 Mode shares – evening survey 3pm till 7pm responses



1.4 Commuter car parking demands

A summary of the station off-street car parking provisions and commuter demands are provided in Table 4 and Table 5 for the morning (9am) and evening (3pm) peak demand periods.

As noted previously in this report, it is generally accepted by parking practitioners that 85% parking occupancy represents the theoretical or effective capacity of parking supply. When parking occupancy exceeds 85% it is generally more difficult for drivers to find available parking. This can result in undesirable parking practices, such as motorists circulating for parking spaces or parking informally (at times in restricted areas). As shown from the survey results most of the stations along the Geelong corridor have exceeded parking capacity. Other notable findings from the parking demand surveys include:

- In the morning survey period a total of 53 patrons parked their cars at Geelong Station but were not commuters. This equates to approximately 9% of the available parking spaces being used by non-commuters in the morning survey periods. In the evening survey period the total people observed to parking but not using the station dropped to nine patrons, or 2% of the available parking spaces.
- With the South Geelong off-street car being at capacity from 6:00 am, commuters are forced to park on-street. Based on the volume (859 of the 978, or 88%, on-street parking spaces being occupied at 9:30am) and time period extents the vast majority of on-street parking could be attributed to commuters. It is likely that due to the no restriction spaces being full that those parking in the time limited areas are doing so illegally past the nominated time periods.

Figure 8 and Figure 9 show these results graphically across the surveyed Geelong rail corridor.

Table 4 Off-street station car parking supply and demand - morning peak demand time period - 9am

Station	Parking Supply	Parking Occupancy	Capacity %	Parking Remaining
Lara	585	552	94%	33
North Shore	63	21	33%	42
North Geelong	544	540	99%	4
Geelong	464	426	92%	38
South Geelong	545	532	98%	13
Marshall	433	390	90%	43
Waurm Ponds	368	300	82%	66
Totals	3,002	2,761	92%	241

Table 5 Off-street station car parking supply and demand - evening peak demand time period – 3pm

Station	Parking Supply	Parking Occupancy	Capacity %	Parking Remaining
Lara	585	558	95%	27
North Shore	63	23	37%	40
North Geelong	544	536	99%	8
Geelong	464	389	84%	75
South Geelong	545	530	97%	15
Marshall	433	424	98%	9
Waurm Ponds	368	342	93%	26
Totals	3,002	2,802	93%	200

Figure 8 Car parking demand - morning peak demand time period - 9am

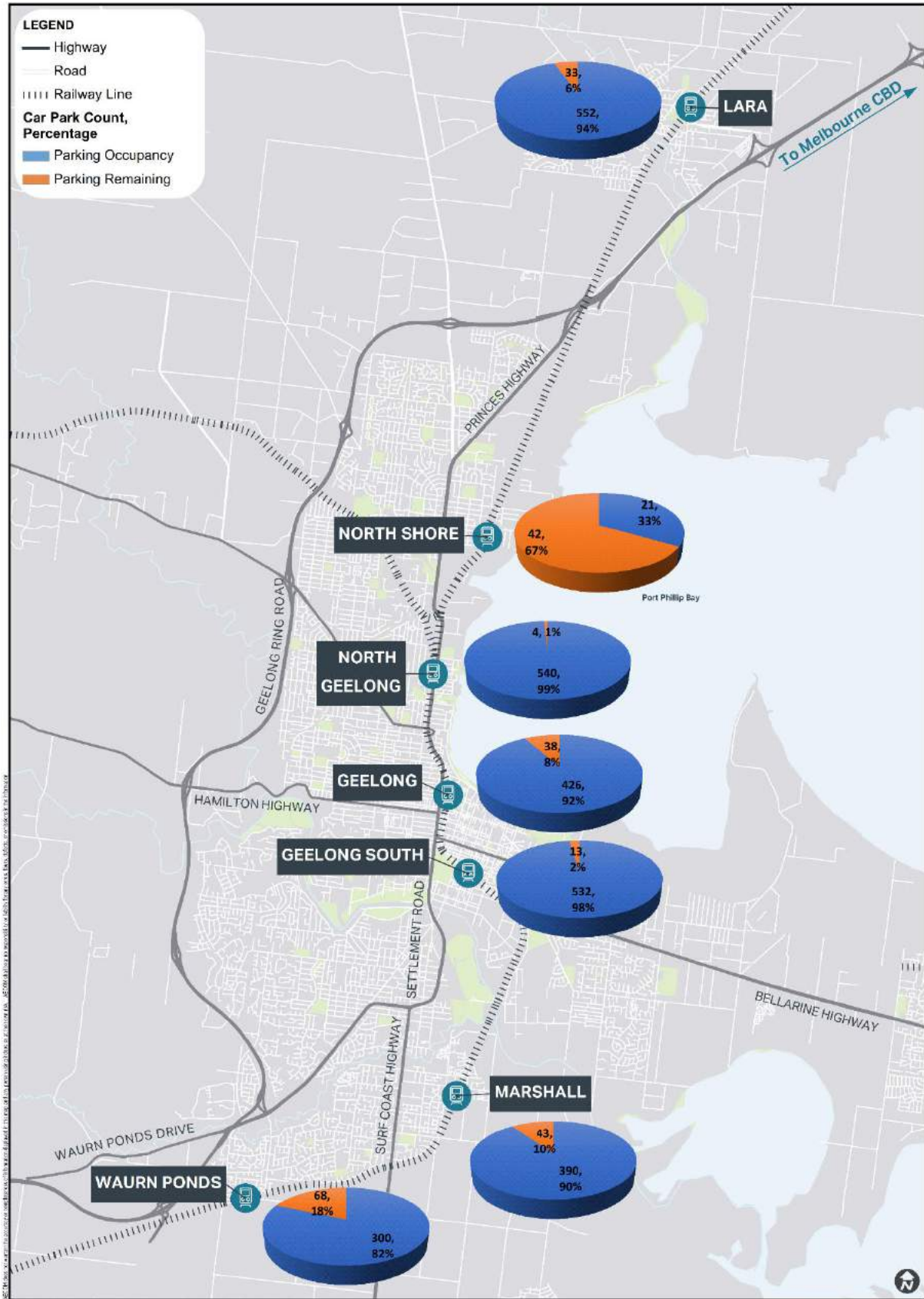
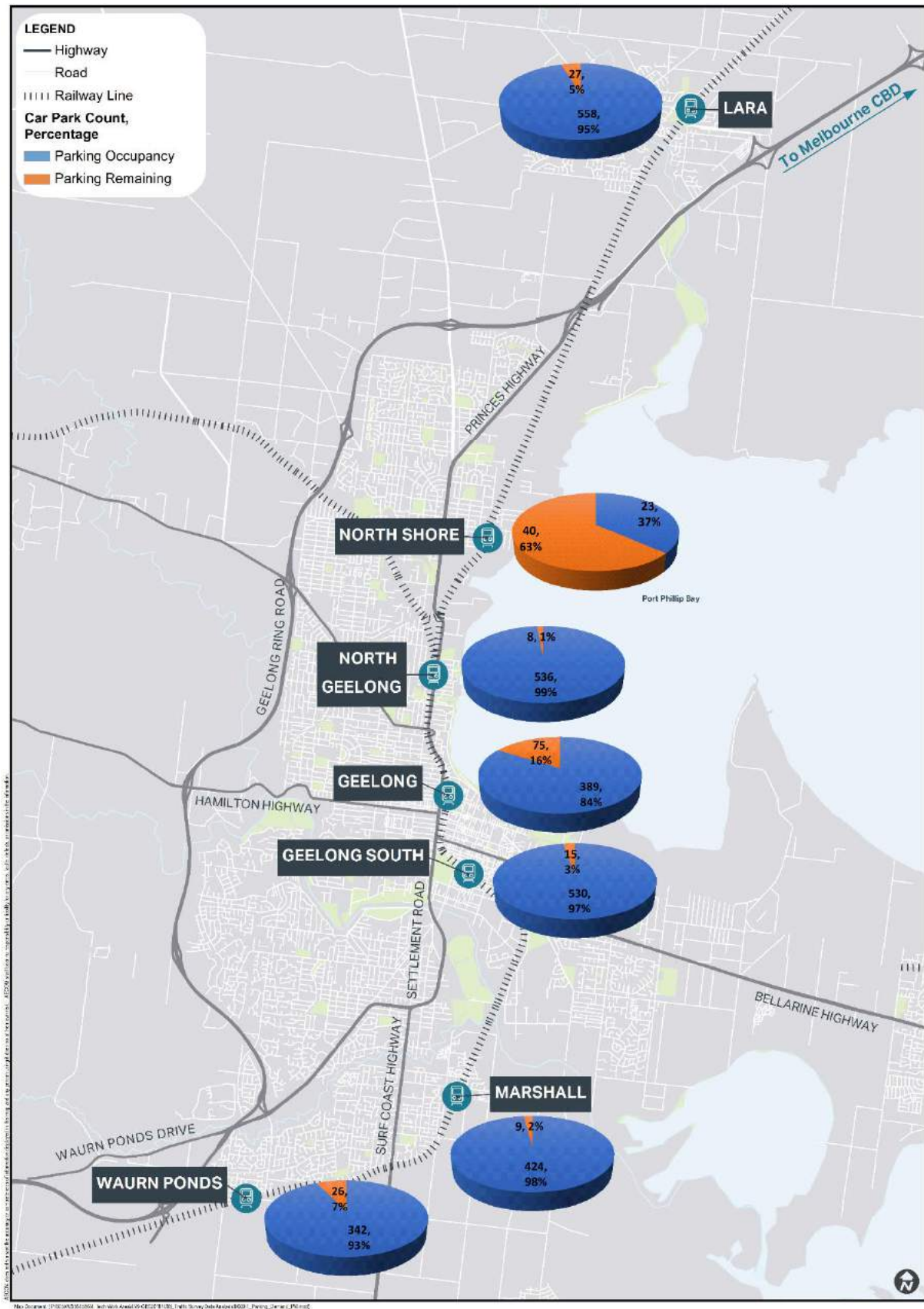


Figure 9 Car parking demand - evening peak demand time period – 3pm



1.5 Non-station users

During the surveys, observations were made to ascertain whether commuters were parking in the station car parks and using the train to commute, or simply using the station car park for other reasons (e.g. parking freely for work purposes).

Figure 10 and Figure 11 show the survey observations in the morning and evening survey time periods respectively. It demonstrates that only at Geelong Station that observations of people parking and not using the station to commute was observed.

The peak parking demands at the eastern and western Geelong car parks was surveyed to be 179 and 426 cars respectively during the morning survey period. A total of 93 (52% of total demand) and 50 (12% of total demand) patrons who parked in the Geelong eastern and western car parks respectively did not use the station.

The peak parking demands at the eastern and western Geelong car parks was surveyed to be 161 and 389 cars respectively during the evening survey period. A total of 109 (68% of total demand) and 130 (33% of total demand) patrons who parked in the Geelong eastern and western car parks respectively did not use the station. This survey time period gives a more informative insight into parking habits at Geelong Station when compared to the morning survey period, as a number of cars were already parked prior to survey commencement in the morning (300 cars at 6am).

Figure 12 and Figure 13 show the response graphically over the study corridor.

Figure 10 Non-station users - morning peak time period - 6am till 930am

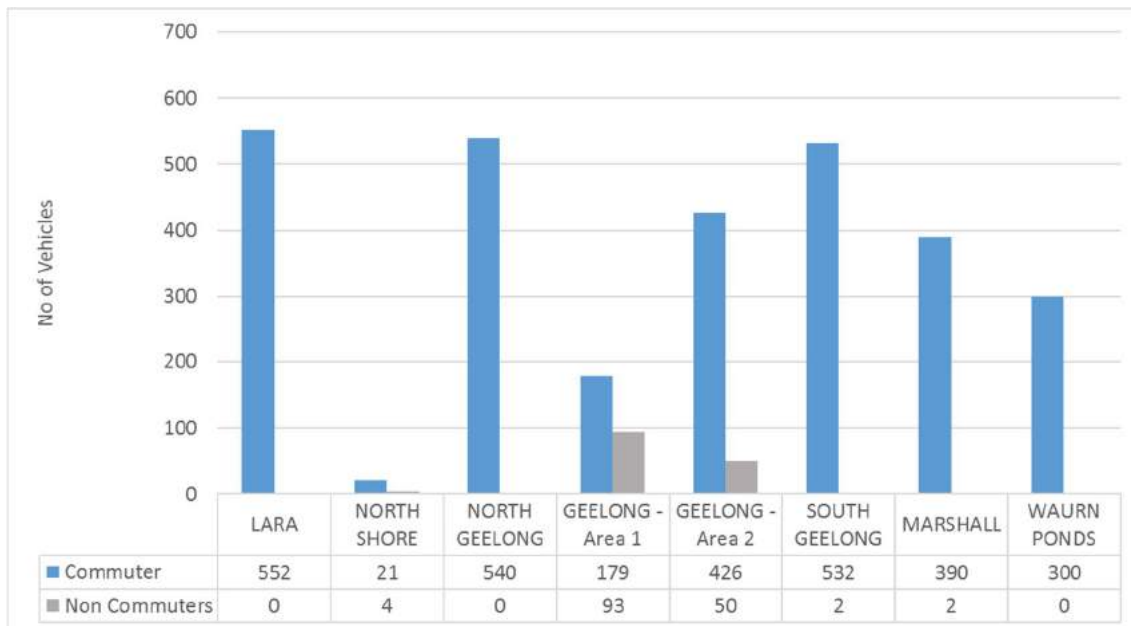


Figure 11 Non-station users - evening peak time period – 3pm till 7pm

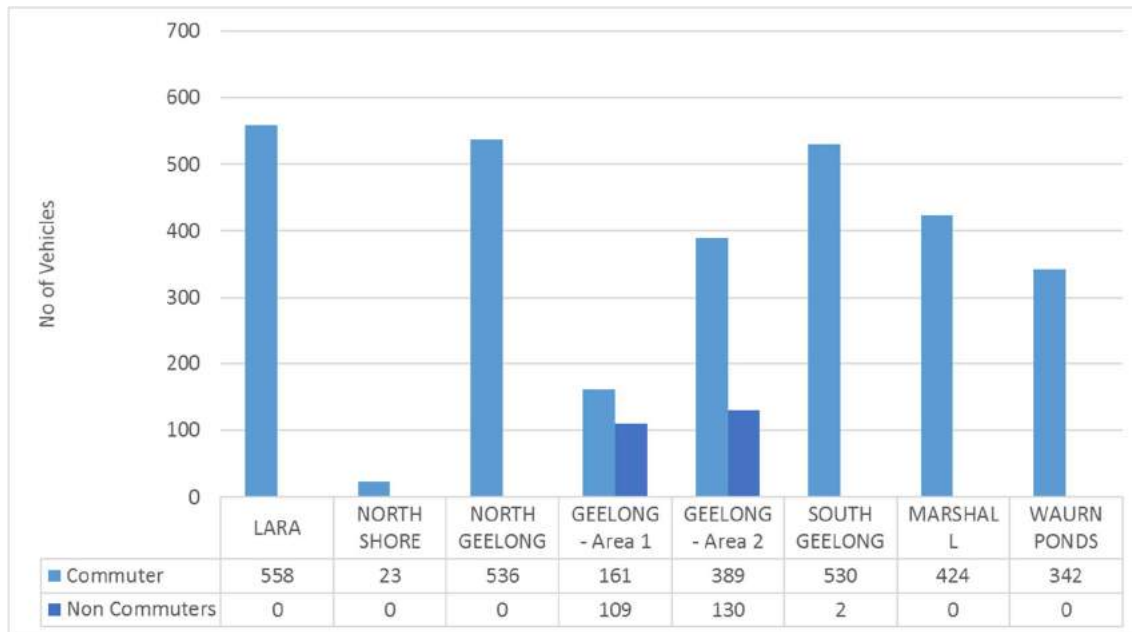


Figure 12 Non-station users - morning peak time period - 6am till 930am

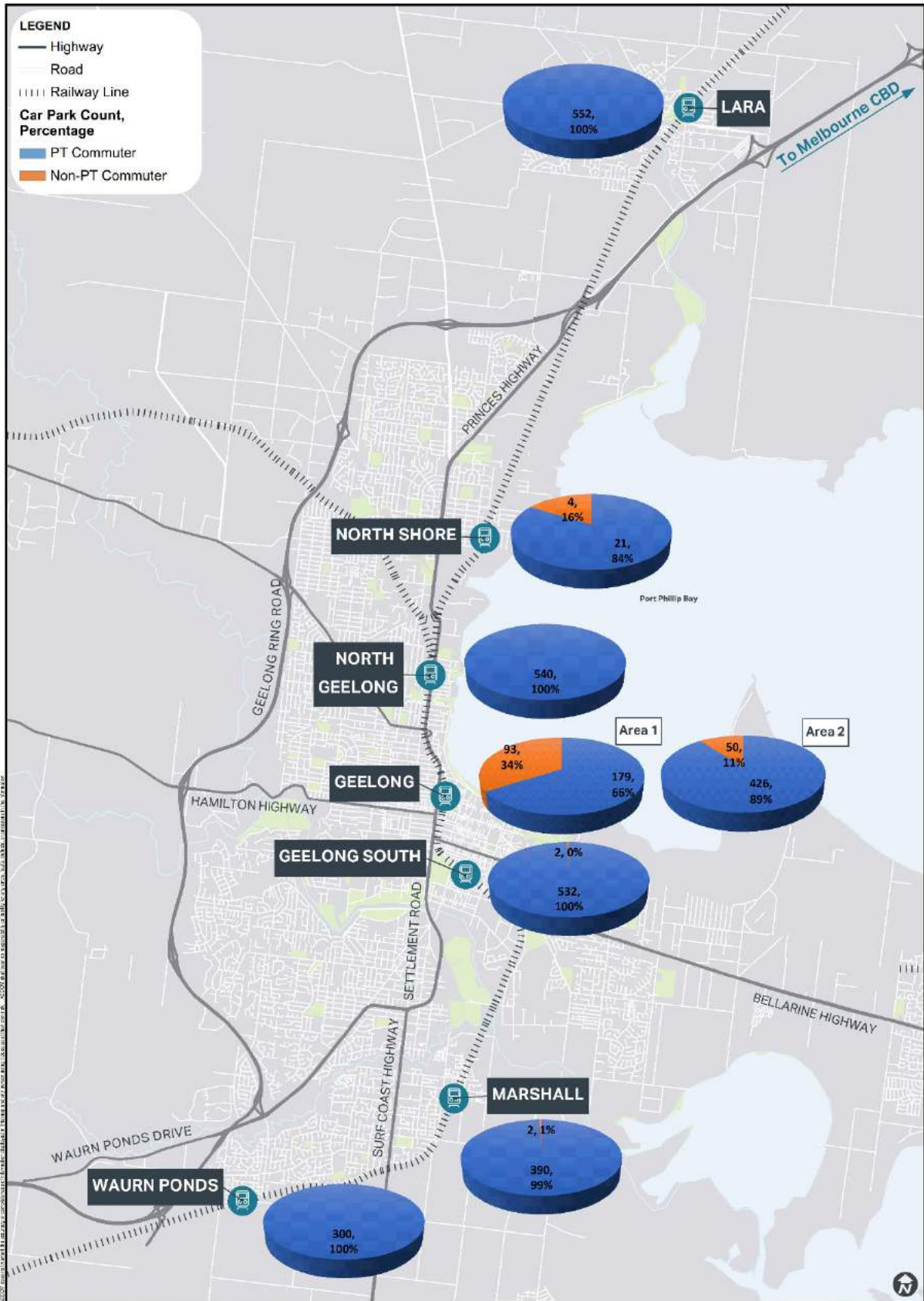
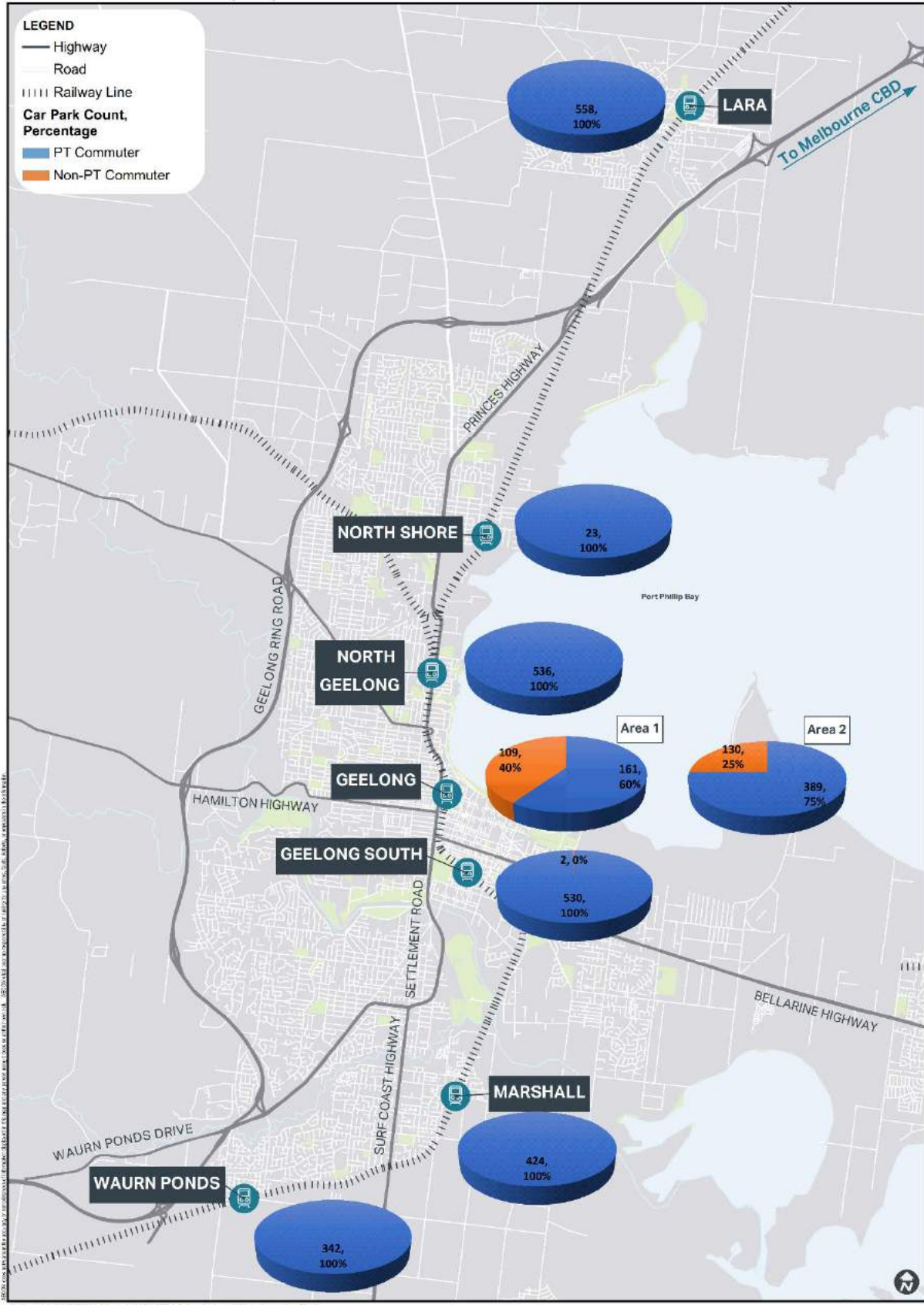


Figure 13 Non-station users - evening peak time period – 3pm till 7pm



1.6 Car parking location

Table 6 and Table 7 outline the survey results of where did patrons park at the respective Geelong corridor stations during the morning (6am till 930am) and evening (3pm till 7pm) survey periods.

Those parking on-street at North Shore and Marshall were likely doing so for convenience since there was parking supply off-street to accommodate. Those parking on-street from Lara and notably South Geelong are doing so due to the off-street car park being at capacity.

Figure 14 and Figure 15 show the car parking location results graphically along the Geelong corridor.

Table 6 Car parking location - morning survey period (6am till 930am)

Station	Car parking location - Total			Car parking location - Percentage		
	Car Park	On-Street	Total	Car Park	On-Street	Total
Lara	31	9	40	78%	23%	100%
North Shore	8	5	13	62%	38%	100%
North Geelong	90	11	101	89%	11%	100%
Geelong	36	4	40	90%	10%	100%
South Geelong	36	39	75	48%	52%	100%
Marshall	30	7	37	81%	19%	100%
Waurm Ponds	48	0	48	100%	0%	100%

Table 7 Car parking location - evening survey period (3pm till 7pm)

Station	Car parking location - Total			Car parking location - Percentage		
	Car Park	On-Street	Total	Car Park	On-Street	Total
Lara	17	2	19	89%	11%	100%
North Shore	4	3	7	57%	43%	100%
North Geelong	17	1	18	94%	6%	100%
Geelong	26	1	27	96%	4%	100%
South Geelong	10	9	19	53%	47%	100%
Marshall	12	0	12	100%	0%	100%
Waurm Ponds	4	0	4	100%	0%	100%

Figure 14 Car parking location - morning peak time period - 6am till 930am

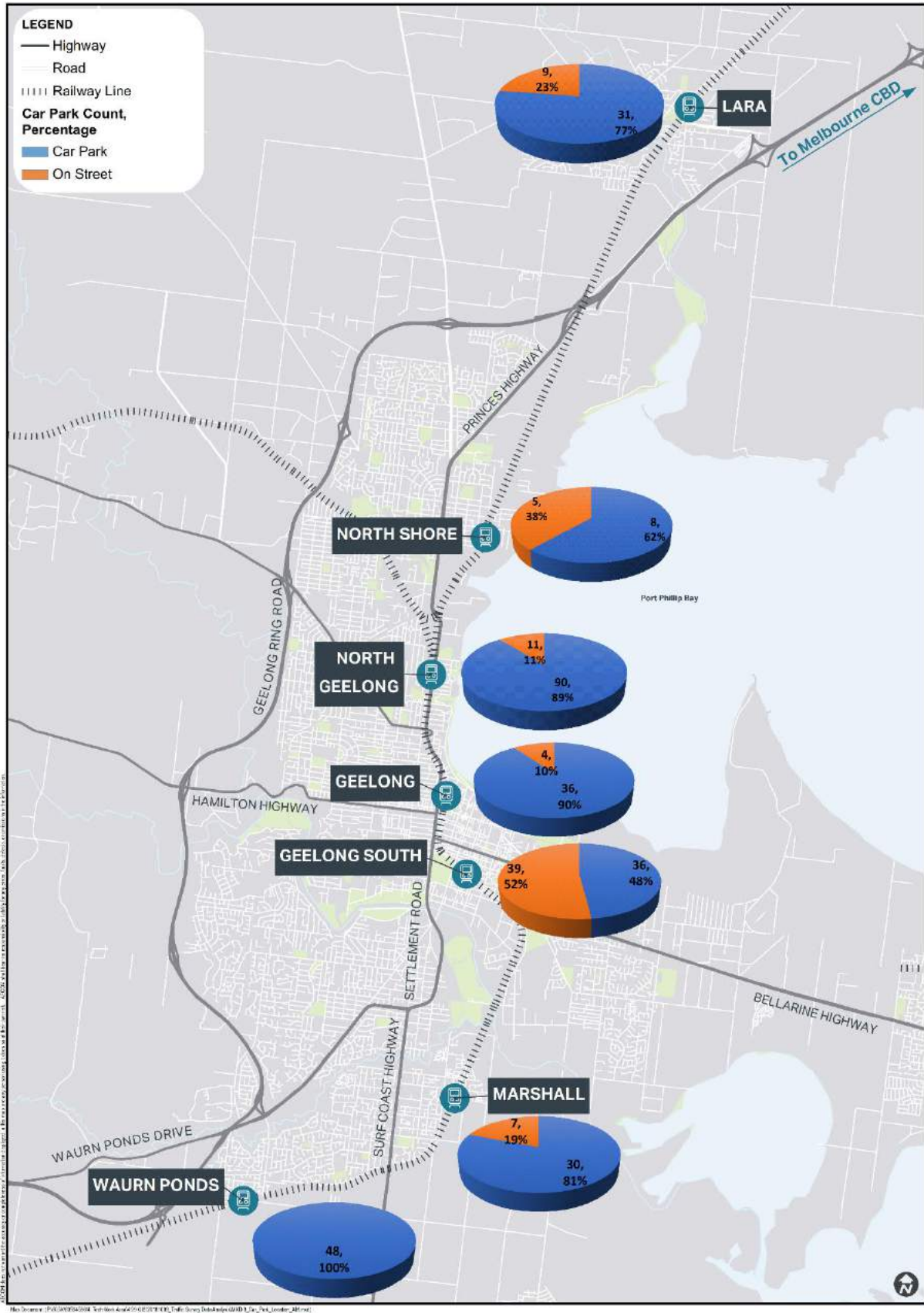
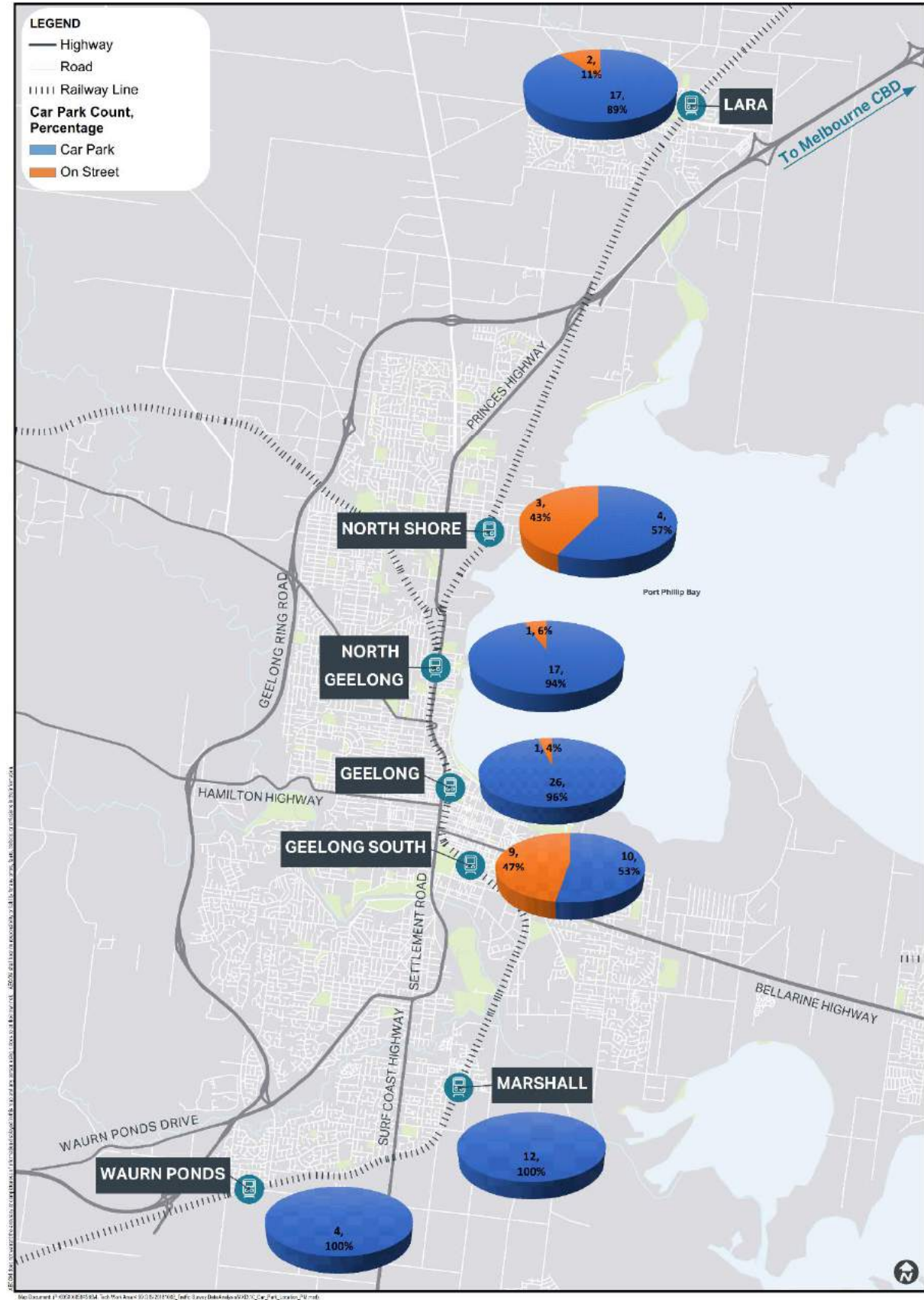


Figure 15 Car parking location - evening peak time period – 3pm till 7pm



1.7 Requests for more parking

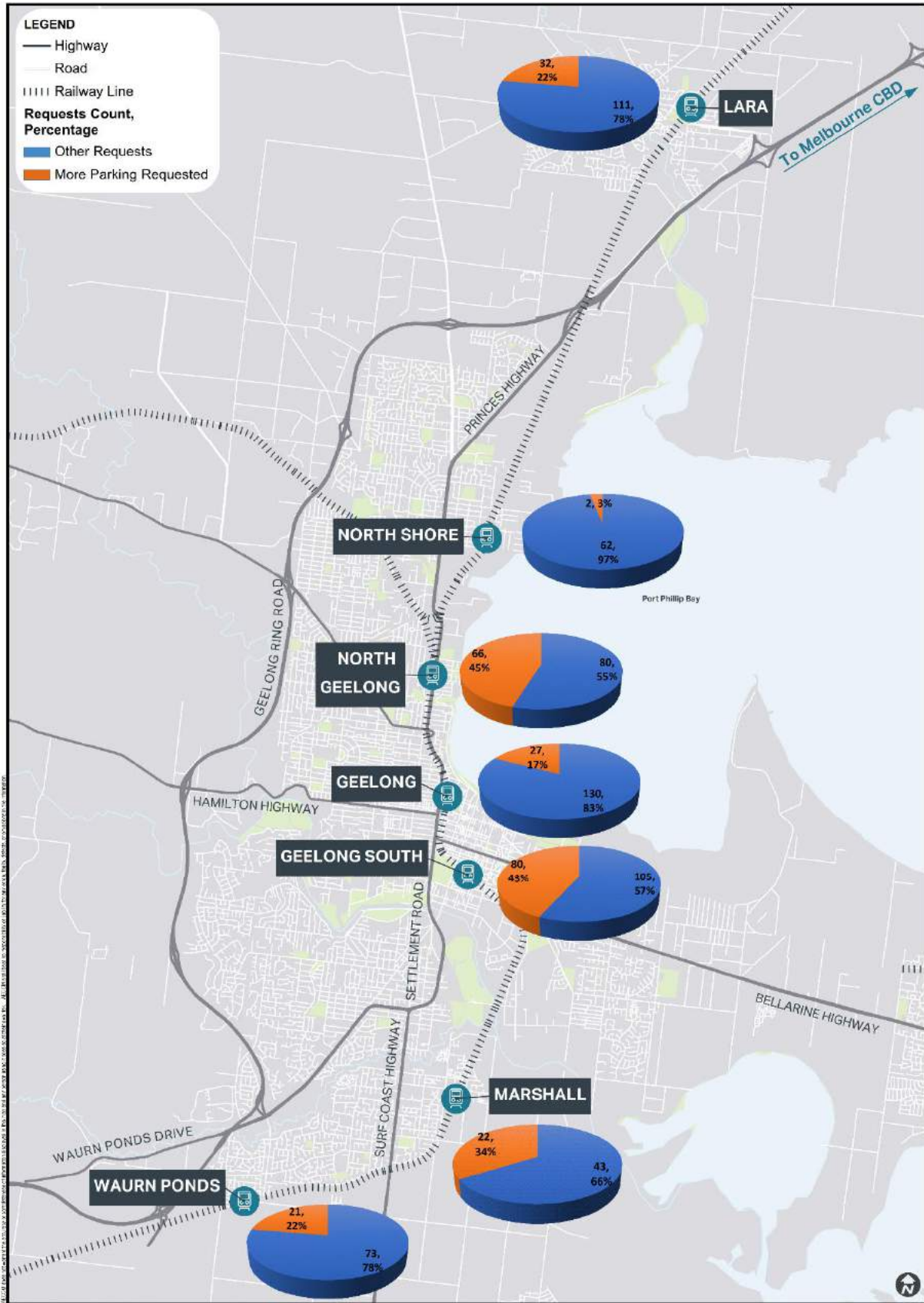
As part of the questionnaire surveys the commuters were asked what suggested improvements they would make to either the station or transport links. **Table 8** shows from the total survey responses those that requested for more parking at their respective station. As shown a total of 854 people were surveyed across all the stations with 250 (29%) requesting for more car parking. Notable stations where more parking was requested was at North Geelong (45%), South Geelong (43%) and Marshall (34%).

Figure 16 shows the survey responses graphically along the study corridor.

Table 8 Questionnaire survey - requests for more parking

Station	Total Surveyed	Other Requests	More Parking Requested	
			Total	Percentage
Lara	143	111	32	22%
North Shore	64	62	2	3%
North Geelong	146	80	66	45%
Geelong	157	130	27	17%
South Geelong	185	105	80	43%
Marshall	65	43	22	34%
Waurin Ponds	94	73	21	22%
Total	854	604	250	29%

Figure 16 Questionnaire survey – requests for more parking



Appendix E

Walking, Cycling and Road Character Assessment

Appendix E – Walking, Cycling and Roads Assessment

This appendix presents the background scores for each of the components of the pedestrian, cycling and roads evaluations, as well as an overview of how these have been applied to inform the Station Access Principles used to assess each station.

Station Access Principles

The Station Access Principles providing the guiding framework for the evaluation of stations can be defined as follows:

- **Net customer gain:** This factor is aimed at estimating the potential combined patronage impacts of various types of upgrade works. The potential gain or loss of riders owing to each of the individual elements below is highly reliant on the specifics of each station context:
 - Gain or loss of parking
 - Supplementation of existing bus services with higher frequencies, new services, or improved facilities
 - Increase of pedestrian activity owing to intensification or reorientation of development surrounding the station sites
 - Improved accommodation of cycling access resulting from enhanced connecting paths or improved or expanded bike storage facilities.
- **Multiple mode access:** This measure assesses the degree to which the station accommodates a shift toward use of equitable, efficient and sustainable modes of transport. This includes evaluation of the suitability of each station to pedestrian, cycling and bus access.
- **Pedestrian access:** To form a complete picture of the suitability of each station to potentially drawing and generating pedestrians, it is critical to examine the following factors:
 - Proximity of pedestrian activity generators, particularly within an 800 to 1000 metre catchment of the railway station
 - Attractiveness and safety of the pedestrian connections to and from the stations
 - Accessibility including width, grades and safety features of access paths and traffic crossings, to ensure that the station is accessible by all people from all directions.
- **Bicycle access:** In contrast with pedestrian access, this measure assesses the multitude of design evaluation factors with specific relevance to cyclists, including:
 - Type and sizing of bicycle storage facilities, with emphasis on the number of cycle parking berths that are covered and secure
 - Location of bicycle storage facilities as specifically related to convenience of access, i.e. access to station platforms from the bike parking area and access to the bike parking area from connecting pathways without requiring lengthy dismount/walk-up zones
 - Alignment, directness and quality of connecting paths
 - Ability to support safe management of conflicts with both cars and pedestrians.
- **Bus transfers:** As a mode of access that will continue to increase in importance as Geelong grows and intensifies, the accommodation of convenient transfers between buses and trains will be a key differentiating element amongst each of the stations. The evaluation related to this factor considers:
 - Location and size of interchange facilities
 - Quality of the walking environment between the bus interchange bays and the station entrance/platforms
 - Strategic location with respect to key feeder bus routes (or new services to be proposed).

- **Car access:** As car access drives the patronage figures of many of the stations in Greater Geelong, it will be important to maintain, expand or manage the parking and access provisions in a manner that conforms with an overall strategy for the corridor. This will need to consider the following:
- **Parking space efficiency:** This measure considers the adaptability of station parking infrastructure to emerging management options such as provision of real-time data to inform travel decisions and efficiently distribute parking along the corridor. This is largely dependent on the relation of each of the stations to a high-order road network connecting the stations to support this type of fluid decision-making.
- **Parking space priority:** This factor compares the relative priority of parking at each station with respect to other modes of access, based on the complexity of the environment and development/growth character.
- **Customer information:** Assumed to be relatively consistent across all stations, this design objective relates to the potential to incorporate customer information into all facets of the customer experience throughout the station area.

Pedestrian and cycling conditions assessment

For the evaluation of the walking environment surrounding each station, a simplified scoring framework was developed to enable a visual comparison of the relative quality of each of the links leading to/from each station, according to the following scale:

0 – Element not present; Conditions hostile (light green)

1 – Average condition or quality (medium green)

2 – Very good treatment or supportive conditions (dark green)

These scores were then aggregated for each station and used as inputs for the evaluation presented in Chapter 4 of this report.

Table 1 shows the application of this analysis to the key elements of the walking environment discussed in Section 4.2.

Table 2 shows the application of this analysis to the key elements of the cycling environment discussed in Section 4.3.

Table 1 Street by street walking evaluation for each station

Key Access Corridors Pedestrian Quality Assessment	Footpaths			Traffic crossings		Weather protection		Context			
	Footpath continuity	Footpath width	Buffers	Safety of crossings	Convenience of crossings	Shade	Shelter	Land uses	Building scale	Contextual gaps	Key destinations
Lara											
Walkers Rd	2	1	2	1	1	2	0	1	1	1	2
Mill Rd	0	0	0	0	0	2	0	0	0	0	0
McClelland Ave	2	2	1	0	1	0	0	1	1	0	1
Rennie St	0	2	1	0	0	1	0	2	2	1	1
Station Lake Rd	2	2	2	2	2	1	0	1	0	1	2
North Shore											
Station St	2	2	2	0	0	1	0	1	1	0	1
Abery Rd	0	0	0	0	0	0	0	0	0	0	0
The Esplanade	2	2	1	2	2	0	0	0	0	0	2
Corio Quay Rd	1	2	1	0	0	0	0	0	0	0	0
N Shore Rd	2	2	2	0	0	0	0	1	1	1	1
North Geelong											
Victoria St W	2	2	2	1	1	1	0	0	1	0	0
Princes Hwy N	0	0	0	0	0	1	1	1	2	1	2
Victoria St E	2	2	2	0	0	1	0	2	2	1	1
Princes Hwy S	0	0	0	0	0	0	0	2	1	1	2
Baxter Rd	0	1	2	0	0	1	0	1	1	1	2
Geelong											
Latrobe Terrace N	2	0	0	1	0	0	0	1	1	0	0
Mercer St	2	2	2	1	0	0	0	1	1	1	2
Brougham St	2	2	2	2	2	2	1	2	2	2	2
Fenwick St	2	2	2	2	2	1	0	2	2	2	2
Latrobe Terrace S	2	1	0	0	0	0	0	2	1	0	1
Gordon Ave	2	2	0	1	1	0	0	2	1	1	1
South Geelong											
Lonsdale St	1	2	2	1	1	1	0	2	2	2	2
Carr St W	2	0	1	1	1	0	0	1	1	1	0
Yarra St N	2	2	2	1	1	1	0	1	1	1	1
Carr St E	2	2	1	1	1	0	0	1	2	2	1
Yarra St S	2	2	2	0	0	1	0	2	2	2	0
Marshall											
Marshalltown Rd	0	1	1	1	1	0	0	2	1	1	0
Station Rd	2	2	2	1	1	0	0	1	2	1	0
Drews Rd	1	1	1	1	1	0	0	1	2	1	0
Barwarre Rd	0	0	0	1	1	0	0	1	1	1	0
Waurn Ponds											
Sugargum Dr	2	2	2	1	2	0	0	1	1	1	0
Bodega St	2	2	2	1	1	0	0	1	1	1	0
Ghazeepore Rd	1	2	2	1	1	0	0	1	0	0	0
Rossack Dr	2	2	2	1	1	0	0	1	1	1	0

Table 2 Street by street cycling evaluation for each station

Key Access Corridors Cycling Quality Assessment	Cycling facilities			Traffic crossings		Nature of traffic		Cycling environment			
	Continuity of paths/lanes	Width of paths/lanes	Buffer from traffic	Safety of crossings	Convenience of crossings	Traffic speed	Turning conflicts	Traffic volumes	Topography	Landscape	Key destinations
Lara											
Walkers Rd	0	0	0	0	1	1	1	1	2	2	0
Mill Rd	0	0	0	0	1	1	2	1	2	2	2
McClelland Ave	0	0	0	0	1	0	1	1	2	1	1
Rennie St	1	0	0	1	1	0	1	1	2	2	0
Station Lake Rd	2	2	0	0	1	1	1	1	2	1	2
North Shore											
Station St	1	1	0	1	0	0	1	1	2	1	0
Abery Rd	2	1	0	1	0	0	2	1	2	2	0
The Esplanade	0	0	0	0	1	0	1	1	2	1	2
Corio Quay Rd	0	0	0	0	0	0	2	1	2	1	0
N Shore Rd	0	0	0	0	0	0	1	1	2	1	0
North Geelong											
Victoria St W	1	0	0	1	1	1	1	1	2	1	0
Princes Hwy N	0	0	0	0	0	0	1	0	2	1	1
Victoria St E	0	0	0	0	1	1	1	1	2	2	2
Princes Hwy S	0	0	0	0	0	0	0	0	2	1	1
Baxter Rd	0	0	0	1	1	1	1	1	2	1	1
Geelong											
Latrobe Terrace N	0	0	0	0	0	0	0	0	2	0	0
Mercer St	0	1	0	1	1	0	0	0	2	1	2
Brougham St	2	2	1	2	2	1	1	1	2	2	2
Fenwick St	2	2	1	2	2	1	1	1	2	2	2
Latrobe Terrace S	0	0	0	0	0	0	0	0	2	0	0
Gordon Ave	0	0	0	0	0	1	2	1	1	1	2
South Geelong											
Lonsdale St	2	1	2	1	1	2	2	2	2	2	2
Carr St W	0	0	0	1	1	1	0	0	2	1	1
Yarra St N	1	2	0	1	1	0	0	0	2	2	2
Carr St E	0	0	0	1	1	1	0	0	2	2	0
Yarra St S	1	2	0	0	0	0	0	0	2	1	0
Marshall											
Marshalltown Rd	0	0	0	1	1	1	1	1	2	2	0
Station Rd	1	1	0	1	1	1	2	2	2	2	0
Drews Rd	2	2	0	1	1	1	1	2	2	2	0
Barwarre Rd	0	0	0	1	1	0	2	1	2	2	0
Waurn Ponds											
Sugargum Dr	1	1	0	1	2	2	2	2	2	2	0
Bodega St	1	1	0	1	1	2	1	2	2	2	0
Ghazeepore Rd	1	0	0	1	1	1	1	1	2	2	0
Rossack Dr	0	0	0	1	1	1	1	1	2	2	0

Table 3 shows the totals of the pedestrian scores for each access corridor to/from each station, based on the following scale:

Facilities score: 0 (non-existent or poor quality) to 10 (high quality) summed from the *footpath* and *traffic crossings* scores

Climate score: 0 (no shade or shelter) to 5 (good shade and shelter) based on the *weather protection* scores with an added weighting to *shade*

Context score: 0 (few pedestrian attractors and non-supportive land uses/scales) to 10 (numerous pedestrian attractors plus supportive land uses and walking-scale design) with double-weight to the *land uses* score

Total score: The sum of the *facilities*, *climate* and *context* scores, totalling 0 to 25.

Accessibility score: Sum of the scores for *footpath continuity*, *footpath width*, and *safety of crossings*; used as an input for the overall comparative station scoresheet.

The totals for each station (shown in bold beneath each station subset) represent the average scores for all the corridors leading to and from the station.

Table 4 shows the totals of the cycling scores for each access corridor to/from each station, based on the following scale:

Facilities score: 0 (non-existent or poor quality) to 10 (high quality) summed from the *cycling facilities* and *traffic crossings* scores

Conflict score: 0 (high traffic speeds plus numerous turn conflicts) to 5 (modest speeds and few conflicts) based on the *nature of traffic* scores with an added weighting to *speeds*

Context score: 0 (few cycling attractors and poor cycling environment) to 10 (numerous cycling attractors plus supportive landscapes and streetscapes) with double-weight to the presence of key origins and destinations within the cycling catchment

Total score: The sum of the *facilities*, *conflict* and *context* scores, totalling 0 to 25.

The totals for each station (shown in bold beneath each station subset) represent the average scores for all the corridors leading to and from the station.

Table 3 Summary of pedestrian scores for each station access corridor

Key Access Corridors					
Pedestrian Quality Assessment	<i>Facilities score</i>	<i>Climate score</i>	<i>Context score</i>	Total score	<i>Accessibility score</i>
Lara					
Walkers Rd	7	3	6	16	4
Mill Rd	2	3	1	6	1
McClelland Ave	6	0	4	10	4
Rennie St	3	1.5	8	12.5	2
Station Lake Rd	10	1.5	5	16.5	6
North Shore	5.6	1.8	4.8	12.2	3.4
Station St	6	1.5	5	12.5	4
Abery Rd	0	0	0	0	0
The Esplanade	9	0	2	11	6
Corio Quay Rd	5	0	0	5	4
N Shore Rd	6	0	5	11	4
North Geelong	5.2	0.3	2.4	7.9	3.6
Victoria St W	8	1.5	1	10.5	5
Princes Hwy N	0	2.5	7	9.5	0
Victoria St E	7	1.5	8	16.5	4
Princes Hwy S	0	0	8	8	0
Baxter Rd	3	1.5	6	10.5	1
Geelong	3.6	1.4	6.0	11.0	2.0
Latrobe Terrace N	3	0	3	6	3
Mercer St	7	0	6	13	5
Brougham St	10	4	10	24	6
Fenwick St	10	1.5	10	21.5	6
Latrobe Terrace S	3	0	7	10	3
Gordon Ave	6	0	7	13	5
South Geelong	6.5	0.9	7.2	14.6	4.7
Lonsdale St	7	1.5	10	18.5	4
Carr St W	5	0	4	9	3
Yarra St N	8	1.5	5	14.5	5
Carr St E	7	0	7	14	5
Yarra St S	6	1.5	8	15.5	4
Marshall	6.6	0.9	6.8	14.3	4.2
Marshalltown Rd	4	0	6	10	2
Station Rd	8	0	5	13	5
Drews Rd	5	0	5	10	3
Barwarre Rd	2	0	4	6	1
Waurm Ponds	4.8	0.0	5.0	9.8	2.8
Sugargum Dr	9	0	4	13	5
Bodega St	8	0	4	12	5
Ghazeepore Rd	7	0	4	11	4
Rossack Dr	8	0	4	12	5
	8.0	0.0	4.0	12.0	4.8

Table 4 Summary of cycling scores for each station access corridor

Key Access Corridors				
Cycling Quality Assessment	<i>Facilities score</i>	<i>Conflict score</i>	<i>Context score</i>	Total score
Lara				
Walkers Rd	1	2.5	5	8.5
Mill Rd	1	3.5	9	13.5
McClelland Ave	1	1	6	8
Rennie St	3	1	5	9
Station Lake Rd	5	2.5	8	15.5
	2.2	2.1	6.6	10.9
North Shore				
Station St	3	1	4	8
Abery Rd	4	2	5	11
The Esplanade	1	1	8	10
Corio Quay Rd	1	3.5	4	8.5
N Shore Rd	0	1	4	5
	1.8	1.7	5.0	8.5
North Geelong				
Victoria St W	3	2.5	4	9.5
Princes Hwy N	0	1	5	6
Victoria St E	1	2.5	9	12.5
Princes Hwy S	0	0	5	5
Baxter Rd	2	2.5	6	10.5
	1.2	1.7	5.8	8.7
Geelong				
Latrobe Terrace N	0	0	2	2
Mercer St	3	0	7	10
Brougham St	9	2.5	9	20.5
Fenwick St	9	2.5	9	20.5
Latrobe Terrace S	0	0	2	2
Gordon Ave	0	3.5	7	10.5
	3.5	1.4	6.0	10.9
South Geelong				
Lonsdale St	7	5	10	22
Carr St W	2	1.5	5	8.5
Yarra St N	5	0	8	13
Carr St E	2	1.5	4	7.5
Yarra St S	3	0	3	6
	3.8	1.6	6.0	11.4
Marshall				
Marshalltown Rd	2	2.5	5	9.5
Station Rd	4	3.5	6	13.5
Drews Rd	6	2.5	6	14.5
Barwarre Rd	2	2	5	9
	3.5	2.6	5.5	11.6
Waurn Ponds				
Sugargum Dr	5	5	6	16
Bodega St	4	4	6	14
Ghazeepore Rd	3	2.5	5	10.5
Rossack Dr	2	2.5	5	9.5
	3.5	3.5	5.5	12.5

Road character assessment

The road character assessment evaluates the level to which each road link to and from each station appropriately balances its multifunctional demands in relation to its land use and urban design contexts. It draws from the walking and cycling assessment as follows, referencing the elements shown in **Table 5**:

Control of crossings: Based on the sum of the *traffic crossings* scores from the walking assessment

Perceived priority: Based on the sum of the *facilities* scores from the walking and cycling assessments

Pedestrian volumes: Measures the potential for walking activity based on the *context* score from the walking assessment

Cyclist volumes: Measures the potential for cycling activity based on the *context* score from the cycling assessment

General orientation: Based on the sum of the *contexts* scores from both the walking and cycling assessments.

Table 6 shows the key outcomes of the road character assessment, according to the following scale:

Road score: 0 (hostile to pedestrians and cyclists) to 10 (very safe and comfortable for walking and cycling) based on the sum of the *road character* scores, with double weight on *perceived priority*

Context score: 0 (unsuitable to pedestrian and cycling activity) to 10 (very well suited to high levels of pedestrians and cyclists) based on the sum of the *land use & urban design context* scores

Difference: A measure of the balance between road character and context ranging from -10 (unsuitable/unsafe roads within an otherwise strong walking/cycling context) to 10 (safe and comfortable walking and cycling corridors despite a relatively car-oriented design context). Scores close to 0 represent a generally appropriate matching of walking and cycling conditions with the expected level of activity based on the surrounding urban design context.

Table 6 Summary of road character scores for each station

Key Access Corridors			
Road Character Assessment	Road score	Context score	Difference
Lara			
Walkers Rd	5	7	-2
Mill Rd	3	4	-1
McClelland Ave	1	5	-4
Rennie St	1	7	-6
Station Lake Rd	8	5	3
North Shore	3.6	5.6	-2.0
Station St	3	4	-1
Abery Rd	1	1	0
The Esplanade	5	4	1
Corio Quay Rd	2	1	1
N Shore Rd	1	3	-2
North Geelong	2.4	2.6	-0.2
Victoria St W	5	2	3
Princes Hwy N	0	4	-4
Victoria St E	4	10	-6
Princes Hwy S	0	5	-5
Baxter Rd	2	5	-3
Geelong	2.2	5.2	-3.0
Latrobe Terrace N	0	2	-2
Mercer St	2	5	-3
Brougham St	8	10	-2
Fenwick St	8	10	-2
Latrobe Terrace S	0	5	-5
Gordon Ave	3	4	-1
South Geelong	3.5	6.0	-2.5
Lonsdale St	7	10	-3
Carr St W	2	4	-2
Yarra St N	3	4	-1
Carr St E	4	5	-1
Yarra St S	2	7	-5
Marshall	3.6	6.0	-2.4
Marshalltown Rd	3	6	-3
Station Rd	6	5	1
Drews Rd	6	6	0
Barwarre Rd	2	5	-3
Waurm Ponds	4.3	5.5	-1.3
Sugargum Dr	8	4	4
Bodega St	7	4	3
Ghazeeopore Rd	5	4	1
Rossack Dr	5	5	0
	6.3	4.3	2.0

Comparison of customer potential by mode

The walking, cycling and road character assessments have been subsequently used as inputs to an overall scoring framework based on the Station Access Principles, to highlight the strengths and disadvantages of each station site.

Table 7 shows the results of this framework, organised according to the following evaluation factors:

Net customer gain

Gain or loss of parking: -2 (reduction of parking may be appropriate) to +2 (increase of parking is suitable to the context)

Increased bus services: 0 (limited opportunity for additional bus patronage) to 2 (significant opportunity for additional bus patronage)

Increased pedestrian activity: 0 (limited opportunity for additional pedestrian access activity) to 2 (significant opportunity for additional pedestrian access activity)

Improved cycling access: 0 (limited opportunity for additional cycling access activity) to 2 (significant opportunity for additional cycling access activity)

Multiple mode access

Pedestrian: Maximum score of 10 calculated from the following three components

Activity: Maximum score of 4 automatically calculated from the *context* score from the walking quality assessment

Connectivity: Maximum score of 3 automatically calculated from the *facilities* score from the walking quality assessment

Accessibility: Maximum score of 3 automatically calculated from the *accessibility* score from the walking quality assessment

Bicycle: Maximum score of 10 calculated from the sum of the following five components

Ability to accommodate cycle parking: Maximum score of 2 based on station and carpark footprint

Location of and access to cycle parking: Maximum score of 2 based on proximity to station platforms and connecting pathway network

Directness of connections: Maximum score of 2 based on orientation of access routes

Quality of connections: Maximum score of 2 automatically calculated from the *facilities* score from the cycling quality assessment

Conflict management: Maximum score of 2 automatically calculated from the *conflicts* score from the cycling quality assessment

Bus: Maximum score of 10 calculated from the following four factors

Location of interchange: Maximum score of 2 based on the relationship between the bus interchange and station platforms

Size/expandability of interchange: Maximum score of 2 based on the station and interchange footprint

Connection between buses and platforms: Maximum score of 2 based on the walking quality of the area separating the interchange and train platforms

Strategic network integration: Maximum score of 2 (double-weighted to a maximum of 4 in the overall bus score) based on the bus routes serving the station and their positioning within the public transport network

Car: Maximum score of 10 based on the following three factors

Adaptability of parking layout: Maximum score of 2 based on the station and carpark footprint

Strategic corridor positioning: Maximum score of 2 (weighted by an additional 50 percent) based on location with respect to the regional road network

Roadway access: Maximum score of 2 (weighted by an additional factor of 2.5) based on proximity to the arterial road network and other major roads

Car (adjusted): The total car score minus the land use integration factor. Low or negative scores indicate a context that is not well suited to expanded car access.

Land use integration: Ranges from -5 to 0 automatically calculated from the *context* score from the road character assessment

Average of alternate modes: Maximum score of 10 based on the average of the pedestrian, bicycle and bus scores.

Table 7 Summary of station enhancement potential

Station Enhancement Potential	Weight	Factor	Source	Lara	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds
Net customer gain										
Gain or loss of parking			auto	0	1	2	-2	0	0	0
Increased bus services			auto	2	0	0	2	2	2	1
Increased pedestrian activity			auto	1	1	1	2	2	1	1
Improved cycling access			auto	2	1	1	1	2	1	2
Multiple mode access										
Pedestrian	10		auto	5.3	4.3	4.5	7.2	6.8	4.8	6.4
Activity	4		auto	1.9	1.0	2.4	2.9	2.7	2.0	1.6
Connectivity	3		auto	1.7	1.6	1.1	2.0	2.0	1.4	2.4
Accessibility	3		auto	1.7	1.8	1.0	2.3	2.1	1.4	2.4
Bicycle	10		auto	6.3	4.0	5.9	5.3	6.4	5.8	7.1
Ability to accommodate cycle parking	2		enter	2	1	2	2	2	2	2
Location of and access to cycle parking	2		enter	2	1	2	1	1	2	2
Directness of connections	2		enter	1	1	1	1	2	0	1
Quality of connections	2		auto	0.4	0.4	0.2	0.7	0.8	0.7	0.7
Conflict management	2		auto	0.8	0.7	0.7	0.6	0.6	1.1	1.4
Bus	10		auto	8	4	2	10	9	8	6
Location of interchange	2		enter	2	1	0	2	2	2	2
Size/expandability of interchange	2		enter	0	1	0	2	1	2	1
Connection b/w buses and platforms	2		enter	2	0	0	2	2	2	1
Strategic network integration	4	2	enter	2	1	1	2	2	1	1
Car	10		auto	4.7	6.2	7.4	1.0	4.5	4.8	4.4
<i>Parking space efficiency</i>										
Adaptability of parking layout	2		enter	2	1	2	0	2	2	1
Strategic corridor positioning	3	1.5	enter	2	1	2	1	2	2	2
<i>Parking space priority</i>										
Roadway access	5	2.5	enter	1	2	2	1	1	1	1
Land use integration	-5		auto	-2.8	-1.3	-2.6	-3.0	-3.0	-2.8	-2.1
Car (adjusted)	10		auto	1.9	4.9	4.8	-2.0	1.5	2.0	2.3
Average of alternate modes	10		auto	6.5	4.1	4.1	7.5	7.4	6.2	6.5

Appendix F

Patronage Forecasting Summary Report

Appendix F – Patronage Forecasting Summary Report

AECOM have undertaken strategic modelling to estimate the future patronage demands by access mode to each of the study railway stations, which is a key objective to inform the Geelong Commuter Car Parking Strategy.

This appendix outlines an overview of the modelling process and the subsequent findings. A full copy of the strategic modelling report is provided in Appendix G.

The modelling undertaken for the project has been reviewed by the Transport for Victoria (Melbourne) modelling team and certified ‘fit-for-purpose’ to inform this commuter car parking strategy.

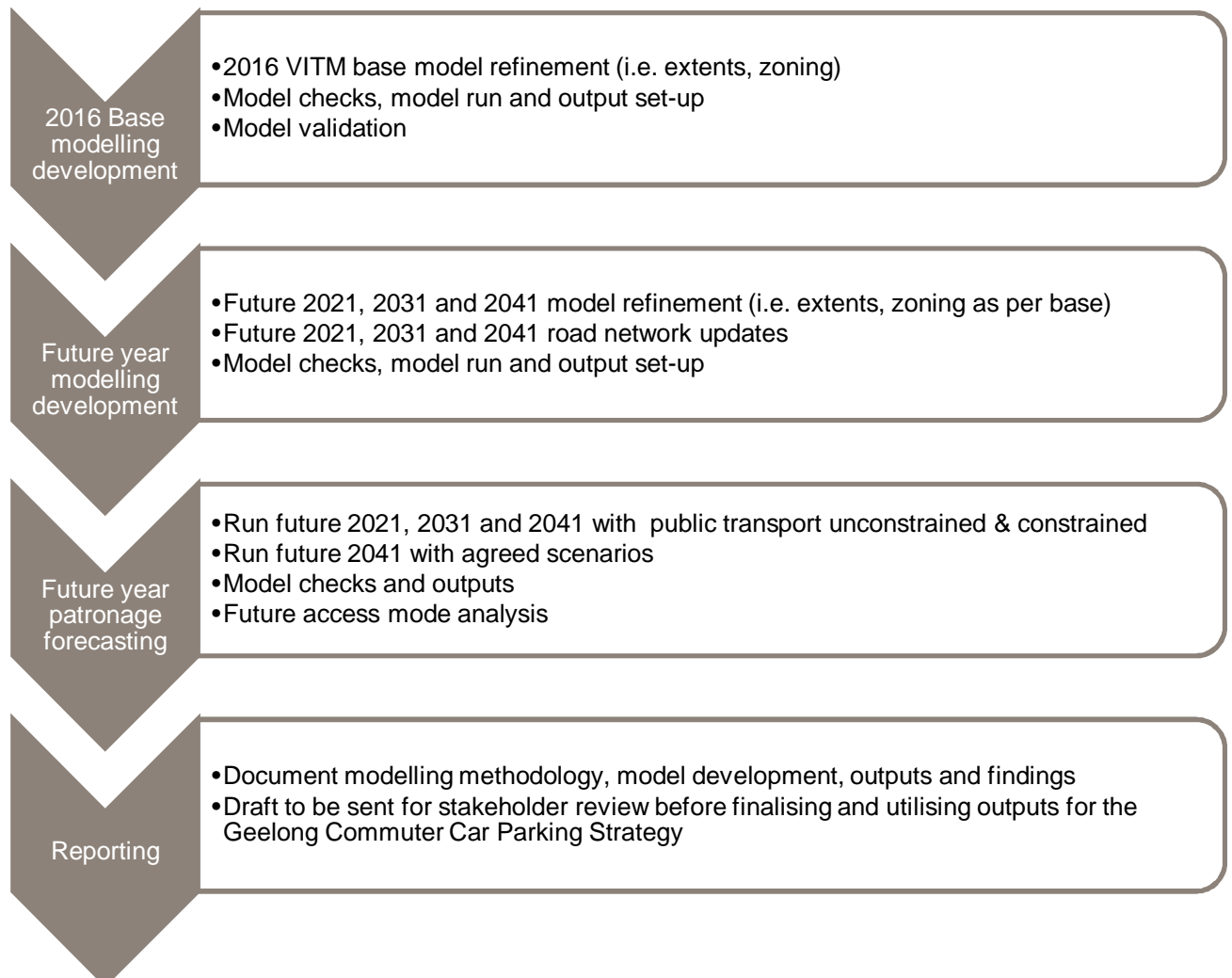
1.1 Modelling overview

The patronage forecasting for the project was undertaken using the statewide version of the Victorian Integrated Transport Model (VITM), a tool developed and maintained by TfV to assist in the planning of road and public transport infrastructure in Victoria.

The VITM is a four-step strategic traffic model which encompasses population, employment and land use projections to forecast future travel behaviours and the potential impacts to the road network.

An overview of the modelling methodology for this project is shown in Figure 1.

Figure 1 Modelling methodology overview



1.2 2016 base year model validation

The model validation guidelines for this study are based on those provided by TfV for use in business case assessments. The model validation guidelines recognise that some aspects of a model are more important than others in developing a model that is fit for purpose. For example, the guidelines may specify, depending on the type of project, that the validation of train loadings at the CBD cordon is very important, while the tram and bus boarding's are of moderate importance.

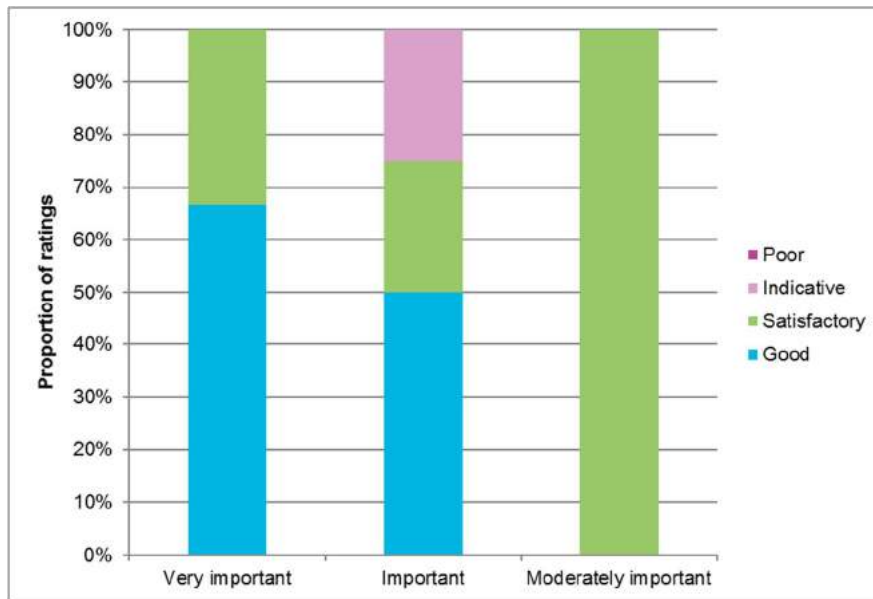
The guidelines provided a ranking/prioritisation of the validation measures, Table 1 provides a summary of the model performance for the different validation measures assessed for the 2016 base VITM model for use in the Geelong Commuter Car Parking Strategy study.

Figure 2 provides the summary validation information in graphical form. This indicates that the model performs at 'satisfactory' or 'good' level for all the very important measures, 75 percent of the important measures, and all of the moderately important measures.

Table 1 Summary of validation performance

Measure	Level of importance	Rating
Public transport boardings by mode	Very important	Good
Metropolitan rail CBD cordon loads by line group	Very important	Good
Metropolitan rail CBD cordon loads by line	Important	Good
Regional rail CBD cordon loads by line	Very important	Satisfactory
Regional rail metropolitan border cordon loads by line	Important	Indicative
Metropolitan rail boardings by line group	Important	Good
Regional rail boardings by line sections	Important	Indicative
Key metropolitan rail station boardings	Important	Satisfactory
Key regional rail station boardings	Important	Satisfactory
Study Area - Station boardings	Important	Good
Study Area - Highway traffic volumes	Important	Good
Study Area - Travel times by mode	Moderately important	Satisfactory

Figure 2 Summary of model performance by level of importance



1.2.1 2016 Base model conclusions

As a strategic model, as expected the VITM performs better at strategic levels, such as boarding’s by mode and by time period, rather than at individual lines and stations. The model also performs better for metro lines than regional lines. The model performance for regional lines could be improved by reviewing the regional network and transit line coding.

At the study area, the model performance on both public transport and highway traffic volumes are good. This is important for the study to provide confidence to use the model to provide demand forecasts by transport mode for future years for the study area.

Overall, the model has performed at a satisfactory level for more than 70 percent of all measures rated ‘moderately important’ to ‘very important’. It is therefore concluded that the model is fit for use to inform the Geelong Commuter Car Parking Strategy.

1.3 Future modelling

1.3.1 Modelling scenarios

The main purpose of the strategic modelling is to determine travel demand by access mode and parking demand at railway stations within the study area.

To estimate the base growth factors, the model runs for the 2016 base year and future years were set with unconstrained public transport capacity and park & ride (P&R) parking capacity so that they can forecast public transport demand and growth without constraint.

The VITM was also run with double constraints, i.e. public transport vehicle capacity constraints and P&R parking constraints at stations for all modelling years to provide a realistic set of growth factors.

As agreed with TfV, sensitivity tests were set up with double constraints for the 2041 future year. They included scenarios of high population growth provided by City of Greater Geelong Council and scenarios with reduced parking capacity at Geelong Station.

The modelling scenarios are shown in Table 2.

Table 2 Modelling scenarios

Scenario No.	Year	PT Unconstrained/ Constrained	Land Use	Road Network	PT Services
1, 2	2016	Unconstrained/Constrained	TFV	2016 Reference	2016 Reference

Scenario No.	Year	PT Unconstrained/ Constrained	Land Use	Road Network	PT Services
3, 4	2021	Unconstrained/Constrained	TFV	2021 Reference	2021 Reference
5, 6	2031	Unconstrained/Constrained	TFV	2031 Reference	2031 Reference
7, 8	2041	Unconstrained/Constrained	TFV	2041 Reference	2041 Reference
9	2041	Constrained	Council	2041 Reference	2041 Reference
10	2041	Constrained	Council	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
11	2041	Constrained	TFV	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
12	2031	Constrained	TFV	2031 Reference	2031 Reference, Zero parking spaces at Geelong Station

The scenarios are further described overleaf.

- PT unconstrained scenario represents a situation in which the capacity of train services and number of parking spaces at the station for P&R are unconstrained and would have no impact on PT travel demand
- PT constrained scenario represents a situation where if the train capacities or number of parking spaces at station are exceeded, passengers would face a penalty in terms of delay and would be encouraged to switch to other transport modes or other stations
- The reference road network would include the road network updates as per the 2012 GGATM model, provided by TfV
- Scenarios 1, 3, 5 & 7 (Base) were used to calculate unconstrained growth of patronage at the railway stations within the study area. Scenarios 2, 4, 6 & 8 (Sensitivity) were used to calculate constrained growth of patronage at these stations, and provide a check on the unconstrained growth rates
- Scenario 9 used the land use data provided by City of Greater Geelong Council. It was compared against Scenario 8 to indicate the impact of high population growth on the Station patronage. To facilitate the model run, the Council land use data was aggregated to be the same VITM (reference model) zone system
- Scenario 10 assumed that the off-street parking capacity at Geelong station was downgraded to near zero, and the parking capacity at other stations (such as Lara, North Geelong, and Marshall) would remain unchanged. The purpose is to investigate the distribution of P&R demand to other stations or other access transport modes when the parking at Geelong Station is removed
- Scenario 11 is similar to Scenario 10 except that the TfV land use data was used
- Scenario 12 is similar to Scenario 11 but run for year 2031 to estimate the impact of parking removed at Geelong Station for an intermediate year.

1.3.2 Analysis methodology

After the model runs for the base and future years were completed, a pivot approach was used to estimate the forecast of passenger entries and parking demand at the study stations. The methodology is described as below:

- Extract the passenger entries at each station within the study area for the base year 2016, and future years, 2021, 2031 and 2041.

- Calculate annual growth factor for each station and apply the growth factors to the observed station entries using a pivot approach.
- Split estimated daily passenger entries by time period using observed data.
- Split passenger entries by time period into three main access modes, walking, bus transfer and park and drive (P&R) using model results.
- Split bus transfer passengers into two sub-modes, cycling and bus. Similarly, P&R passengers were split into P&R driver, P&R passenger and Kiss and Ride (K&R) by using surveyed data from the individual stations.
- Determine the P&R parking demand at each study station by summing the P&R drivers over time periods.

1.3.3 Modelling summary results

A summary of the modelling results for the daily entries by access modes and parking at each study station are provided in the following figures for the considered model scenarios as previously outlined in Table 2.

Figure 3 to Figure 10 provide a summary of daily model predicted volumes for all modelled scenarios by P&R_D, P&R_P, K&R, Cycle, PT, Walk, total passenger entries and parking demands respectively.

It should be noted that the Geelong Growth Area Transport Infrastructure Strategy as part of the VPA Streamlining for Growth funding was commissioned after the Geelong Commuter Car parking study was awarded. Population growth has been considered and the impacts have been evaluated through the additional scenarios which were formulated following Geelong City's small area projections. Further modelling which will be undertaken could form part of a potential future extension to this study.

Furthermore, the Torquay Transit Corridor was commissioned after the Geelong Commuter Car parking study was awarded. The VITM modelling and options development could form the basis to connect to the TTC study at the appropriate time to build on the findings of this study including further refinement of the options that are recommended for Waurm Ponds and Marshall stations. Further modelling which will be undertaken could form part of a potential future extension to this study. This study supports a coordinated approach to integrate key transport projects including the planned Torquay Transit Corridor.

Figure 3 Summary of station daily entries by P&R (driver only) under all scenarios

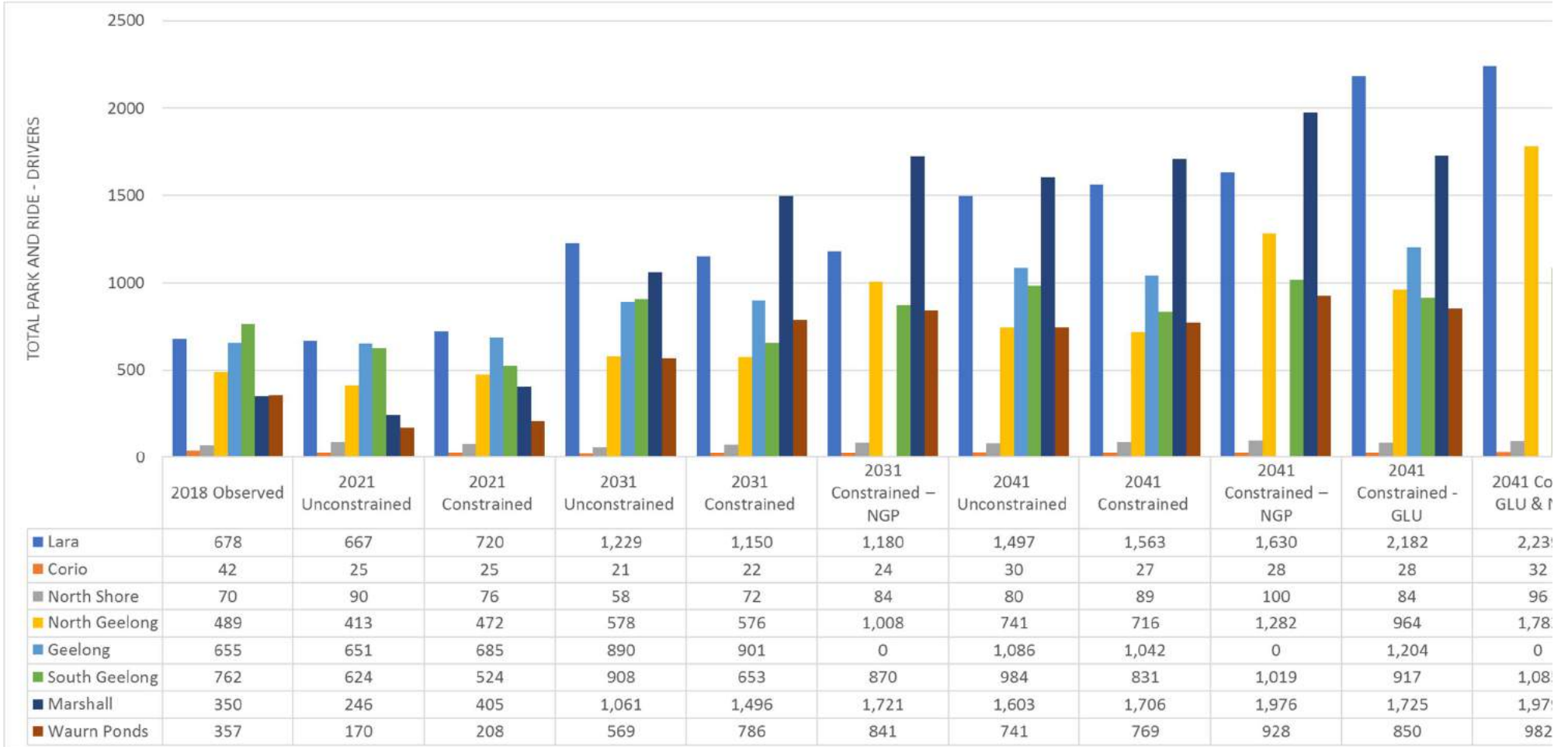


Figure 4 Summary of station daily entries by P&R (passenger only) under all scenarios

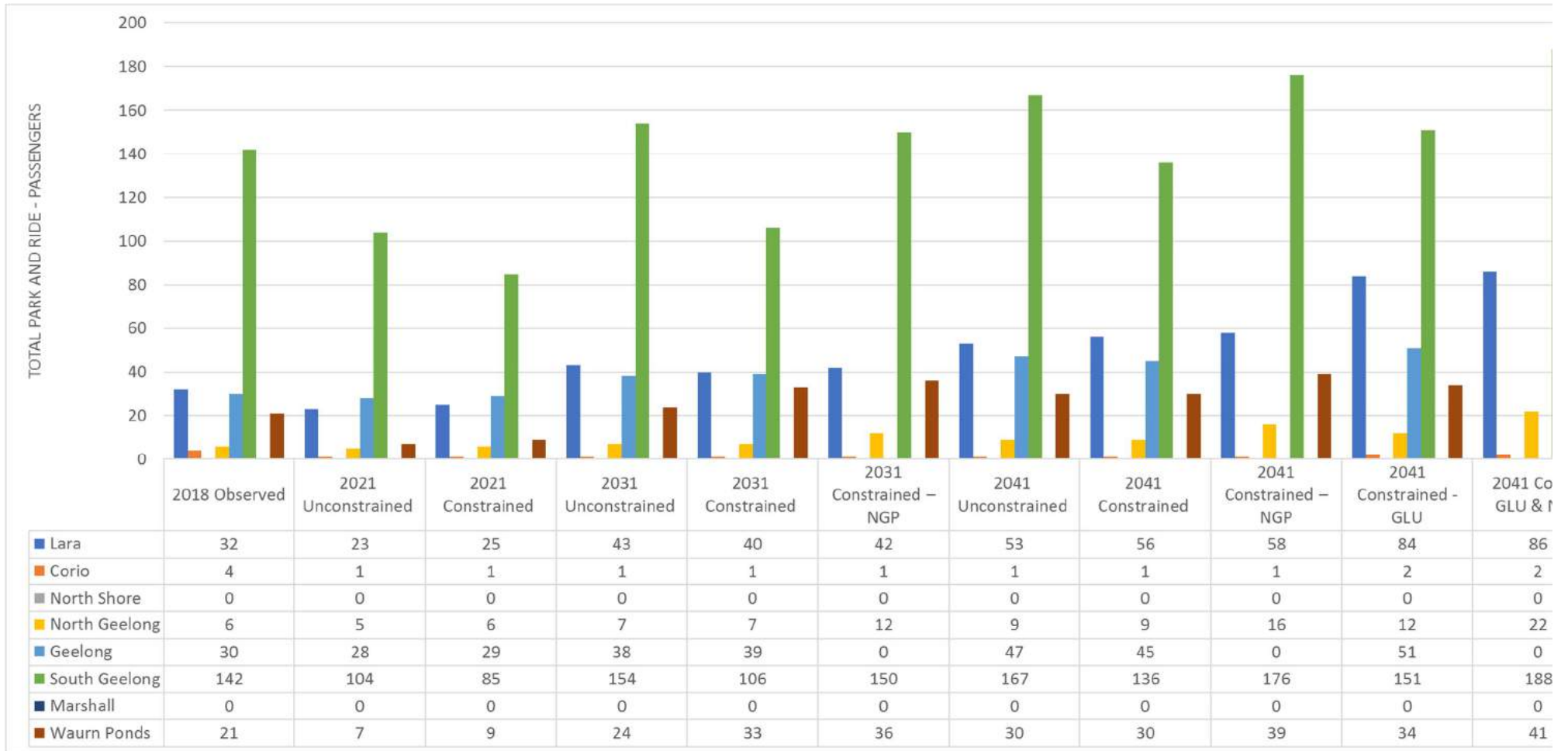


Figure 5 Summary of estimated daily entries by K&R under all scenarios

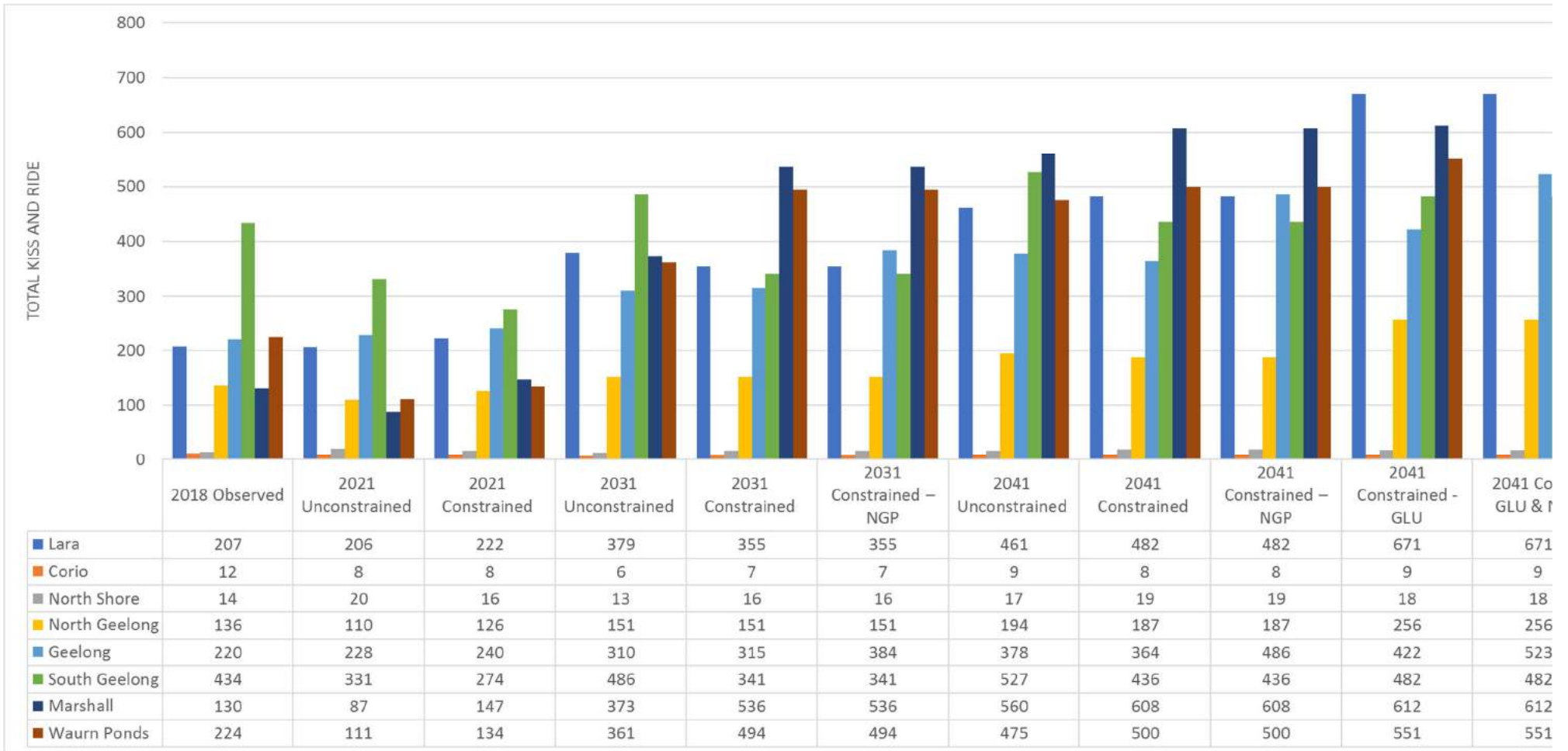


Figure 6 Summary of estimated daily entries by cycle under all scenarios

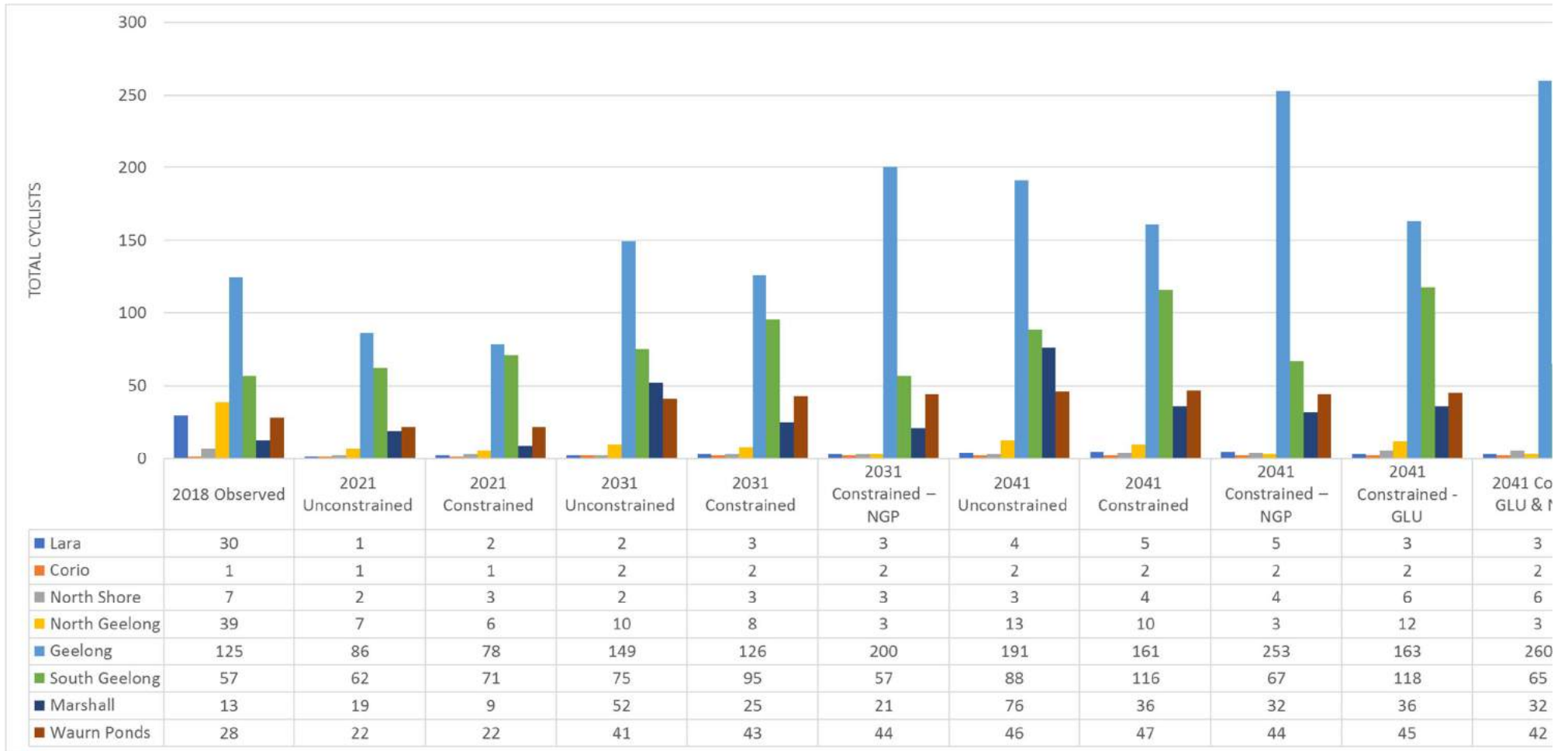


Figure 7 Summary of station daily entries by PT under all scenarios

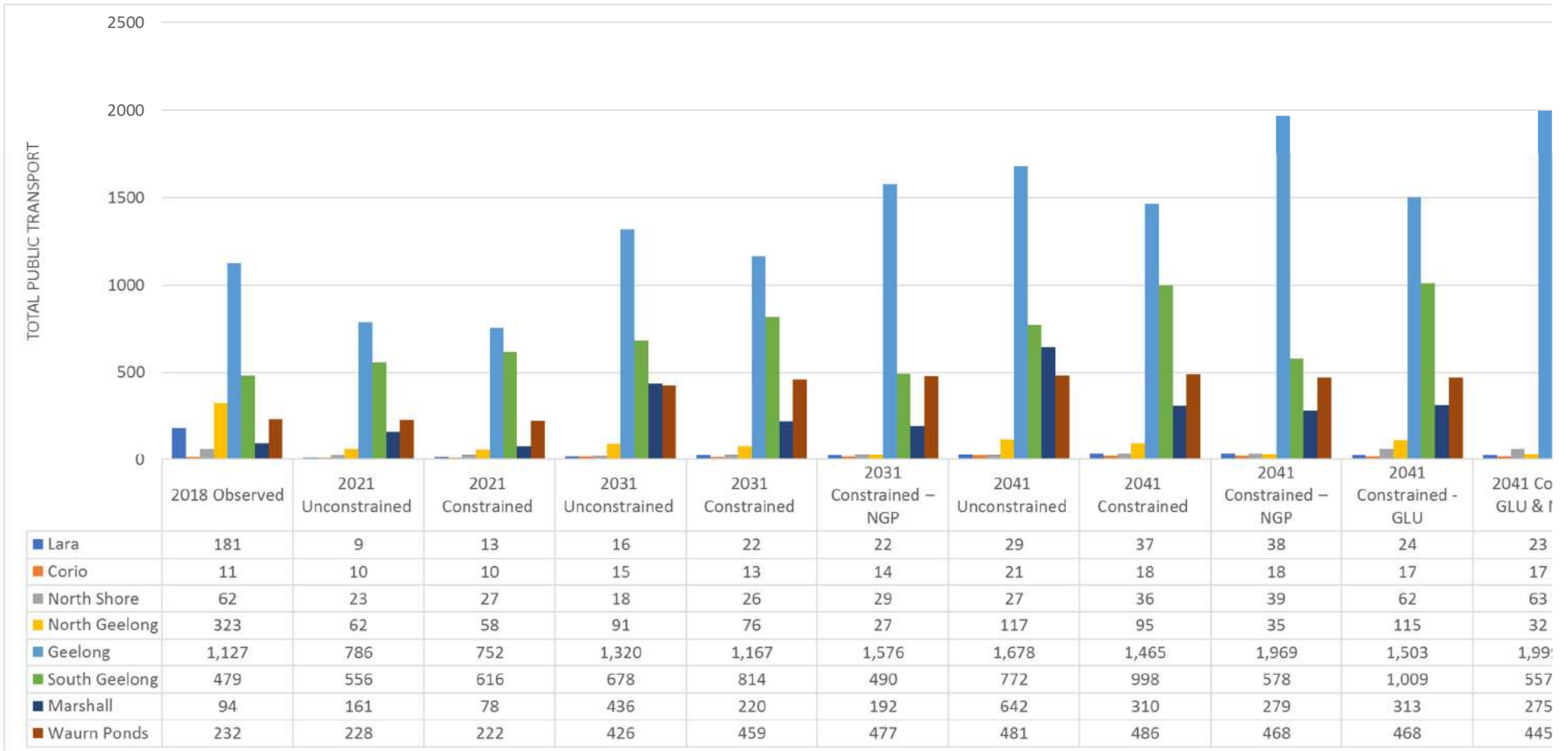


Figure 8 Summary of station daily entries by walk under all scenarios

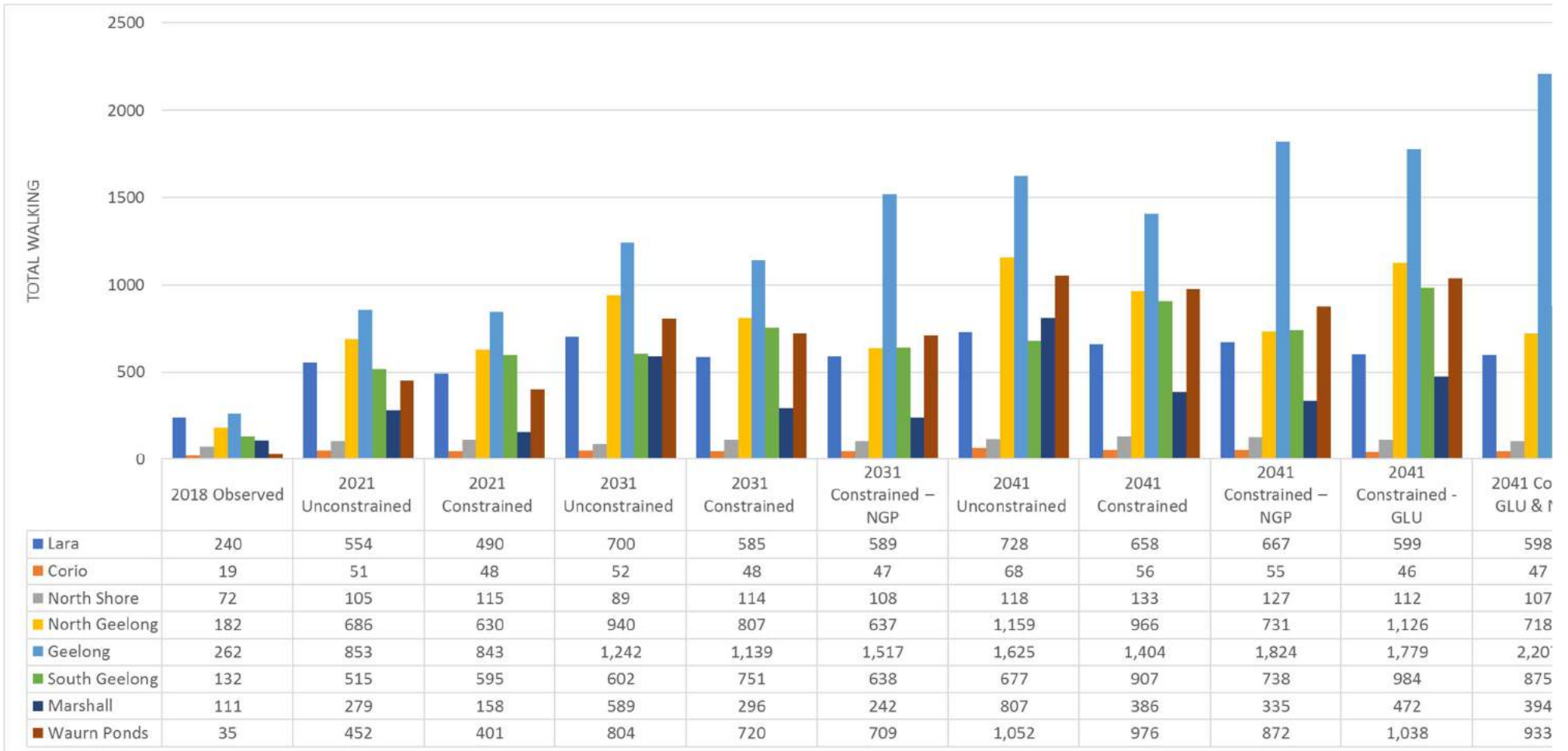


Figure 9 Summary of total daily passenger entries under all scenarios

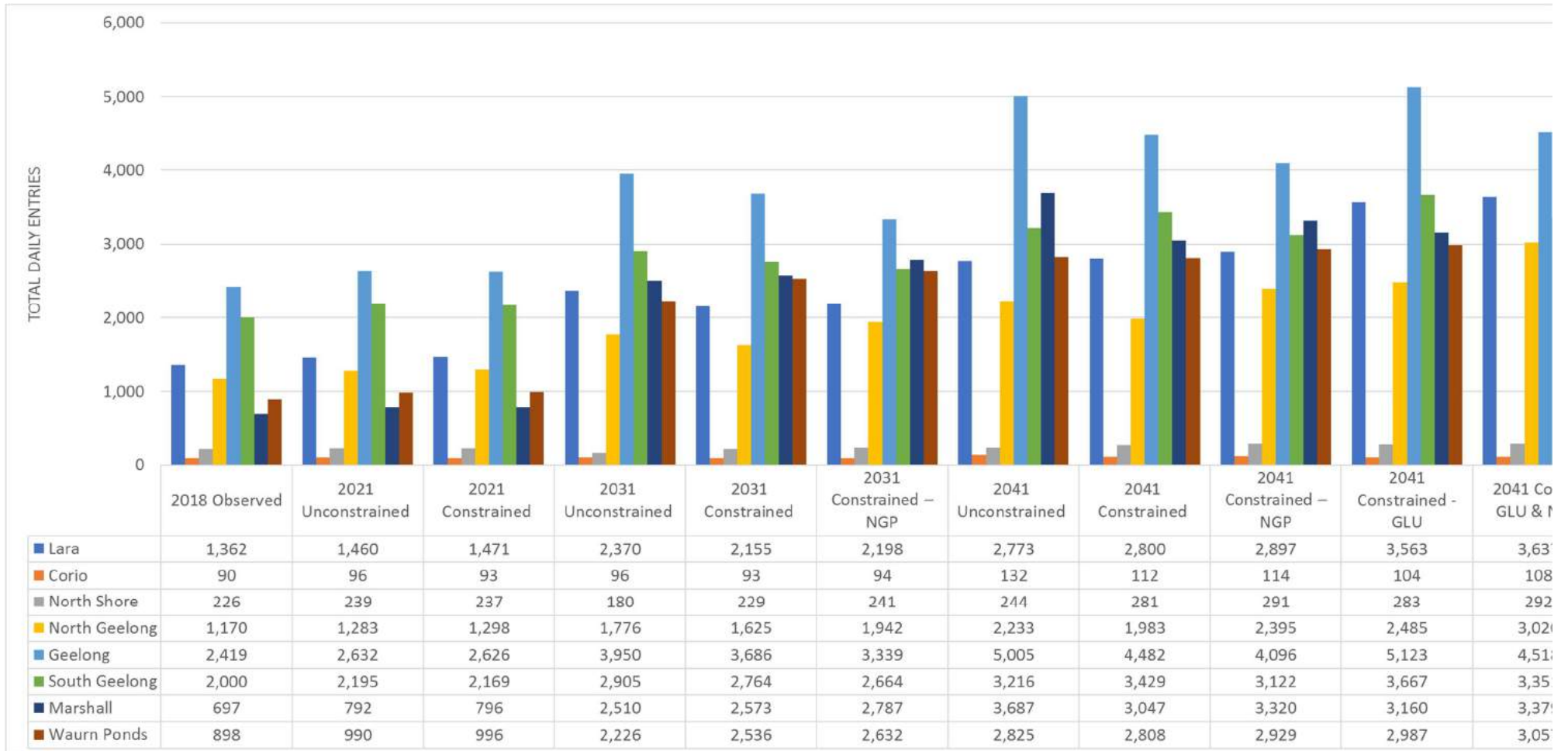
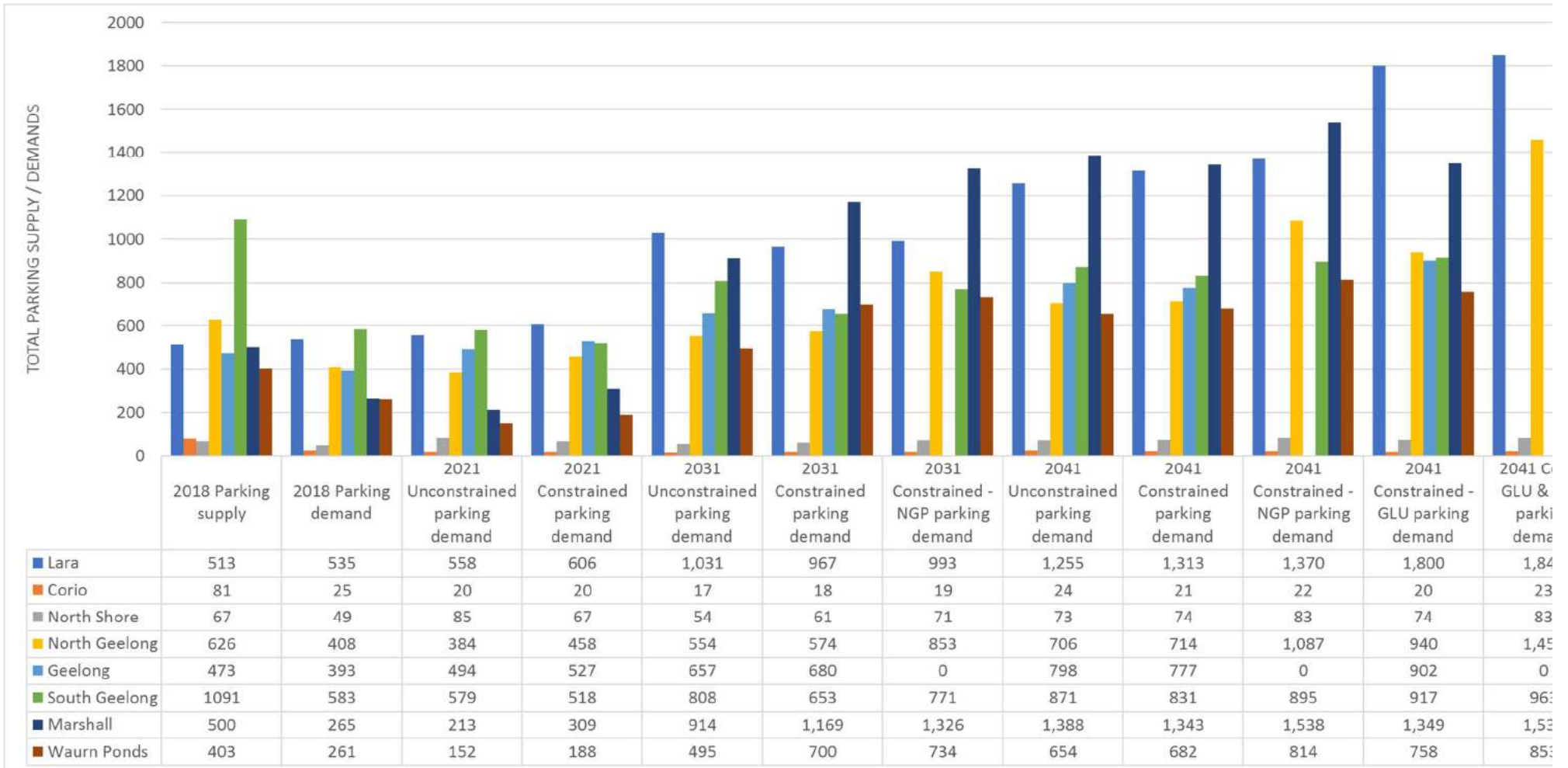


Figure 10 Summary of station parking demand (cars) under all scenarios



1.3.4 Summary of key findings from modelling summary results

1.3.4.1 Overview of unconstrained mode scenario

The total passenger entries are predicted to grow steadily from 9,700 in 2021 to 16,000 in 2031 and 20,100 in 2041. Correspondingly, total parking demands are predicted to grow to 2,500 cars in 2021 to 4,500 in 2031 and 5,800 in 2041.

1.3.4.2 Overview of constrained model scenarios

The total passenger demand is predicted to grow to 9,700 entries in 2021 to 15,700 in 2031 and 19,000 in 2041. The entries are in the same order as those of unconstrained scenarios although slightly lower.

Overall the station entries represent a growth of 3.4 percent per annum between 2021 and 2041, even though the population would grow only at 1.7 percent per annum during the same time period.

Similarly, the number of parking demand is predicted to grow to 2,700 cars in 2021 to 4,800 in 2031 and 5,800 in 2041.

When comparing against the 2041 scenario with TfV land use, the total entries at the stations would increase by 12% while the parking demand would increase by 16%.

At the station level, CCL land use would result in an increase of entries at Lara, North Geelong and Geelong station by 25%, 22% and 14% respectively. Similar growth patterns can be seen in the predicted parking demands which would increase at the same stations by 34%, 25% and 25% respectively. This pattern would be due to the distribution of the additional population at the growth areas near the stations.

1.3.4.3 Removal of parking at Geelong Station

When the parking at Geelong Station is removed, the passenger demand by P&R_D and P&R_P would be reduced by 100% as there is no parking, the other access modes to the station like K&R, Cycle, PT and Walk are predicted to increase by 24%, 60%, 33% and 24% respectively.

Overall the passenger entries to Geelong station would decrease slightly by 3%.

In this scenario it is predicted that the P&R_D demand at adjacent stations like North Geelong, South Geelong would increase by 85% and 18% respectively. Similarly, the P&R_D at further away stations like Corio, North Shore, Marshall and Waurn Ponds would increase by 14%-16%, and the farthest Lara Station would increase by 3%. Interestingly, the passenger demand by Cycle, PT and Walk to the adjacent stations like North Geelong and South Geelong would reduce by significant percentages 11-75%. This could be due to the reason that with the removal of P&R demand, the train loading at Geelong Station would be relieved as such that would attract demand from other access modes not only from the catchment of Geelong Station, but also from nearby stations.

1.3.4.4 Predicted future parking requirements – all scenarios

Table 3 shows that for all individual stations, only the parking supply at Lara station would exceed the demand in 2018, and Geelong station parking supply would be exceeded by 2021. However, when considering the whole study area, all parking supply would only be exceeded by 2031.

Table 3 Summary of station parking demand (cars) under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurin Ponds	Total
2018									
Parking supply	513	81	67	626	473	1091	500	403	3754
Parking demand	535	25	49	408	393	583	265	261	2,517
2021									
Unconstrained	558	20	85	384	494	579	213	152	2,486
Constrained	606	20	67	458	527	518	309	188	2,693
2031									
Unconstrained	1,031	17	54	554	657	808	914	495	4,530
Constrained	967	18	61	574	680	653	1,169	700	4,823
Constrained - NGP	993	19	71	853	-	771	1,326	734	4,768
2041									
Unconstrained	1,255	24	73	706	798	871	1,388	654	5,768
Constrained	1,313	21	74	714	777	831	1,343	682	5,755
Constrained - NGP	1,370	22	83	1,087	-	895	1,538	814	5,809
Constrained - GLU	1,800	20	74	940	902	917	1,349	758	6,760
Cons. - GLU & NGP	1,848	23	83	1,459	-	963	1,539	853	6,767

Appendix G

Strategic Modelling Report

Geelong commuter car parking strategy

Strategic modelling report

Geelong commuter car parking strategy

Strategic modelling report

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B	16-July-2018	Working draft v.2 - Model validation	Geoff Ford Associate Director	
C	28-Oct-2018	Working draft v.3 for client comment and review	Geoff Ford Associate Director	
D	23-Nov-2018	Report	Geoff Ford Associate Director	

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Executive Summary

To inform the development of the Geelong Commuter Car Parking Strategy, AECOM have undertaken strategic modelling to estimate the future patronage demands by access mode to each of the study railway stations, and to estimate the redistribution of parking demand under several scenarios.

Methodology

The demand forecast for the project was undertaken using the statewide version of the Victorian Integrated Transport Model (VITM), a tool developed and maintained by TfV to assist in the planning of road and public transport infrastructure in Victoria. While the model covers the whole state of Victoria, the study area is focused on the Geelong railway corridor line stations at Lara, Corio, North Shore, North Geelong, Geelong, South Geelong, Marshall and Waurin Ponds. Model outputs of highway traffic volumes are focused within Greater Geelong Local Government Area (LGA).

The VITM was used to provide demand forecast for the base year 2016, and future years 2021, 2031 and 2041. A pivot approach was used to estimate the forecast of passenger entries and parking demand at the study stations.

Model validation

The model validation was undertaken using a guideline provided by TfV for a regional rail study in 2017. For the validation, the 2016 base year model was run using the double constraint option including public transport capacity constraint and park and ride (P&R) parking capacity constraint. The model results were compared against available observed data at two levels, global validation and local validation. The global validation considered the overall model performance in terms of public transport boardings by mode, and train loadings and boardings by line. The local validation considered the model performance at the study area in terms of highway traffic volumes by screenlines, passenger boardings at railway stations, and travel times by mode.

As a strategic model, as expected the VITM performed better at strategic levels, such as boardings by mode and by time period, rather than at individual lines and stations. The model also performs better for metro lines than regional lines. The model performance for regional lines could be improved by reviewing the regional network and transit line coding.

At the study area, the model performance on both public transport and highway traffic volumes are good. This is important for the study to provide confidence to use the model to provide demand forecasts by transport mode for future years for the study area.

Overall, the model performed at a satisfactory level for more than 70 percent of all measures rated 'moderately important' to 'very important', and TfV accepted that the model was fit for the purpose to inform the Geelong Commuter Car Parking Strategy.

Future year models

TfV provided the reference VITM models for future years 2021, 2031 and 2041, together with necessary inputs such as demographic data, road network and public transport (PT) service plans. In addition, the City of Greater Geelong (CoGG) provided information relating to high population growth and corresponding future year road networks as part of the scenario testing component.

The future year road networks in the reference models were provided by TfV. They were checked against the existing road network. Errors identified in the existing road network as well as in access links to the railway stations within the study area during the model validation were corrected and incorporated in the future road networks. In addition the proposed road improvements in growth areas identified by the Geelong Growth Area Study were also included in the future road networks.

The travel demand in terms of passenger entries for various scenarios in future was estimated by applying a pivot approach using the observed station entries from Myki data as the base and the growth from the model. The passenger entries were further split into six station access modes by time period. The parking demand in terms of park and ride drivers arriving at each station under various scenarios into the future was also estimated.

The future travel demand by access mode to study stations was estimated by using constrained and unconstrained models. Since the constrained models were able to forecast the redistribution of P&R

demand due to change in parking supply, the constrained models were applied to study the impact of high population growth and removed parking supply at Geelong Station scenarios.

The modelling scenarios agreed with TfV are shown below.

Scenario No.	Year	PT Unconstrained/ Constrained	Land Use	Road Network	PT Services
1, 2	2016	Unconstrained/Constrained	TFV	2016 Reference	2016 Reference
3, 4	2021	Unconstrained/Constrained	TFV	2021 Reference	2021 Reference
5, 6	2031	Unconstrained/Constrained	TFV	2031 Reference	2031 Reference
7, 8	2041	Unconstrained/Constrained	TFV	2041 Reference	2041 Reference
9	2041	Constrained	Council	2041 Reference	2041 Reference
10	2041	Constrained	Council	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
11	2041	Constrained	TFV	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
12	2031	Constrained	TFV	2031 Reference	2031 Reference, Zero parking spaces at Geelong Station

The model forecast indicates that the daily passenger entries to all study stations would increase from 8,900 in 2018 to 9,700 in 2021, 16,000 in 2031 and 20,100 (TfV land use) and 21,400 (Council land use) in 2041. Similarly, the number of parking demand is forecast to grow from 2,500 cars in 2018 to 2,700 in 2021, 4,800 in 2031 and 5,800 (TfV land use) and 6,800 (Council land use) in 2041.

With respect to Geelong station, the daily passenger entries would increase from 2,400 in 2018 to 2,600 in 2021, 4,000 in 2031 and 4,500 (TfV land use) and 5,100 (Council land use) in 2041. Correspondingly, the number of car parking demand is forecast to grow from 400 cars in 2018 to 500 in 2021, 700 in 2031, and 800 (TfV land use) and 900 (Council land use) in 2041. If the parking at Geelong Station was removed, model predicted that the P&R demand would shift to adjacent stations, and the other access modes at the station including K&R, Cycle, Walk and Bus would increase.

In considering the existing parking supply at the stations, only the parking supply at Lara station would exceeded by the demand in 2018, and Geelong station parking supply would be exceeded by 2021. However, when considering the whole study area, all parking supply would only be exceeded by 2031.

In conclusion, this report has provided necessary information on the future patronage by access mode and parking demand at the study railway stations. The information can be used to develop options for improving parking and access to each of the study railway stations to inform the Geelong Commuter Car Parking Strategy.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by Transport for Victoria (TfV) to prepare a Geelong Commuter Car Parking Strategy.

AECOM have undertaken strategic modelling to estimate the future patronage demands by access mode to each of the study railway stations, and to estimate the redistribution of parking demand under several scenarios including the proposed high population growth and the removal of car parking at Central Geelong Railway Station. These are key objectives to inform the Geelong Commuter Car Parking Strategy.

1.1 Purpose of this report

The purpose of this report is to outline the methodology and subsequent future modelling assessments to forecast the future patronage demands by access mode to each of the railway stations considered as part of the Geelong Commuter Car Parking Strategy.

Agreement on the report findings will be sought from TfV before utilising the modelling findings, along with study existing condition assessments, to develop a number of options for improving railway station parking and access for each of the study railway stations.

1.2 Structure of report

The report is structured as follows:

- Chapter 2.0: outlines an overview of the patronage forecast modelling in terms of the methodology, assessment outputs, assumptions and modelling exclusions
- Chapter 3.0: details the 2016 base year model specification and the model validation
- Chapter 4.0: details the future year forecasting of commuters by access mode at the study railway stations
- Chapter 5.0: provides a summary of the undertaken study and the resulting findings.

1.3 Reference documents and data

The following documents and data were referenced in the undertaking of this strategic modelling assessment:

- VITM 2016 model provided by TfV.
- VITM 2021, 2031 and 2041 Reference Case models provided by TfV, in which the future road network would consider proposed road improvements as documented in the Geelong Growth Area Modelling study (2013)
- 2041 land use and road networks based on the high population growth scenario provided by the City of Greater Geelong Council

Although the AECOM proposal suggested developing a VITM 2017 as the base year model, the VITM 2016 provided by TfV was adopted as the base year model because key input parameters to the model like value of time, vehicle operating costs, parking costs and land use data have been recently updated and estimated to 2016. In addition, the public transport validation data was also available for 2016. The 2041 future model was used instead of the 2046 model as suggested in the AECOM proposal because the 2046 Reference Case was no longer supported by TfV.

2.0 Patronage forecasting methodology

2.1 Methodology overview

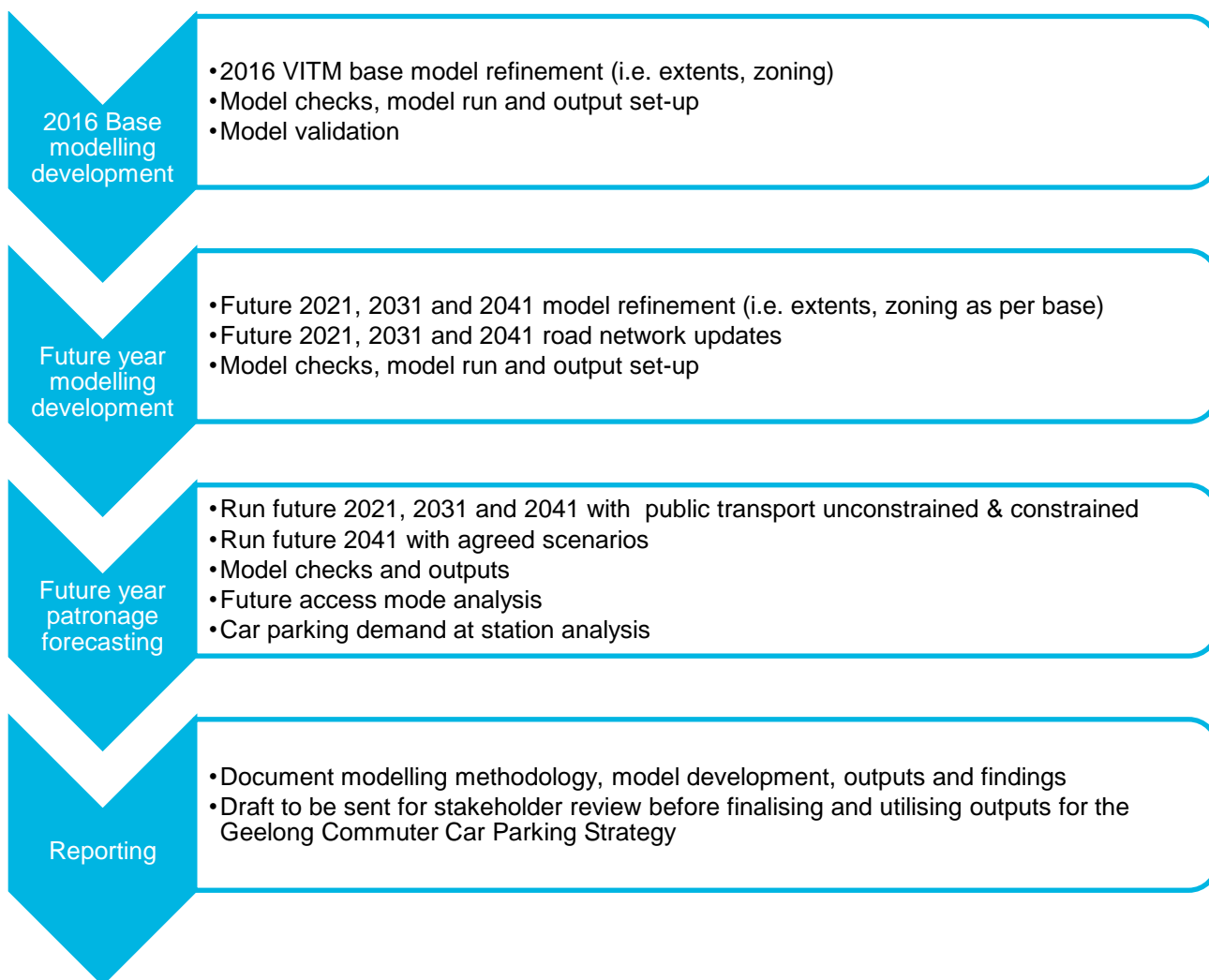
The patronage forecasting for the project was undertaken using the statewide version of the Victorian Integrated Transport Model (VITM), a tool developed and maintained by TfV to assist in the planning of road and public transport infrastructure in Victoria.

The VITM is a four-step strategic traffic model which encompasses population, employment and land use projections to forecast future travel behaviours and the potential impacts to the road network. The model is implemented via the use of the CUBE Voyager software. Features of the VITM include:

- Four-time periods (AM, inter-peak, PM and Off Peak)
- Road and public transport modes
- Three vehicle types, Car, Rigid Trucks and Articulated Trucks
- Three public transport modes, Train (metro and V/Line), Trams and Buses.

An overview of the modelling methodology for this project is shown in Figure 1.

Figure 1 Modelling methodology overview



2.2 Model specifications

This section describes the model specifications for the study, including the VITM version, the zoning system, adjustments made to the model network, and broad model validation results.

2.2.1 Model version

Due to the geographic coverage of the study, the statewide version of VITM was used, with the 2016 version provided by TfV. This version of the VITM incorporates all the functionality of the metropolitan version of VITM, expands the geographic coverage to include the entire state of Victoria and adds the ability to separate long distance inter-city trips from shorter distance intra-city trips.

2.2.2 Transport zones

The statewide version of VITM includes 6981 zones. In this study, the master zone system was aggregated to 2988 zones to optimise the model run times, model convergence and to maintain precision in the key corridors to be assessed. Through this process, only the zones outside the study area were aggregated.

Figure 2 presents the aggregated transport zones in VITM across Victoria and Figure 3 shows the transport zones across Melbourne, Wyndham and Geelong which are mostly at disaggregated or fine level.

Figure 2: The aggregated transport zones in VITM across Victoria.

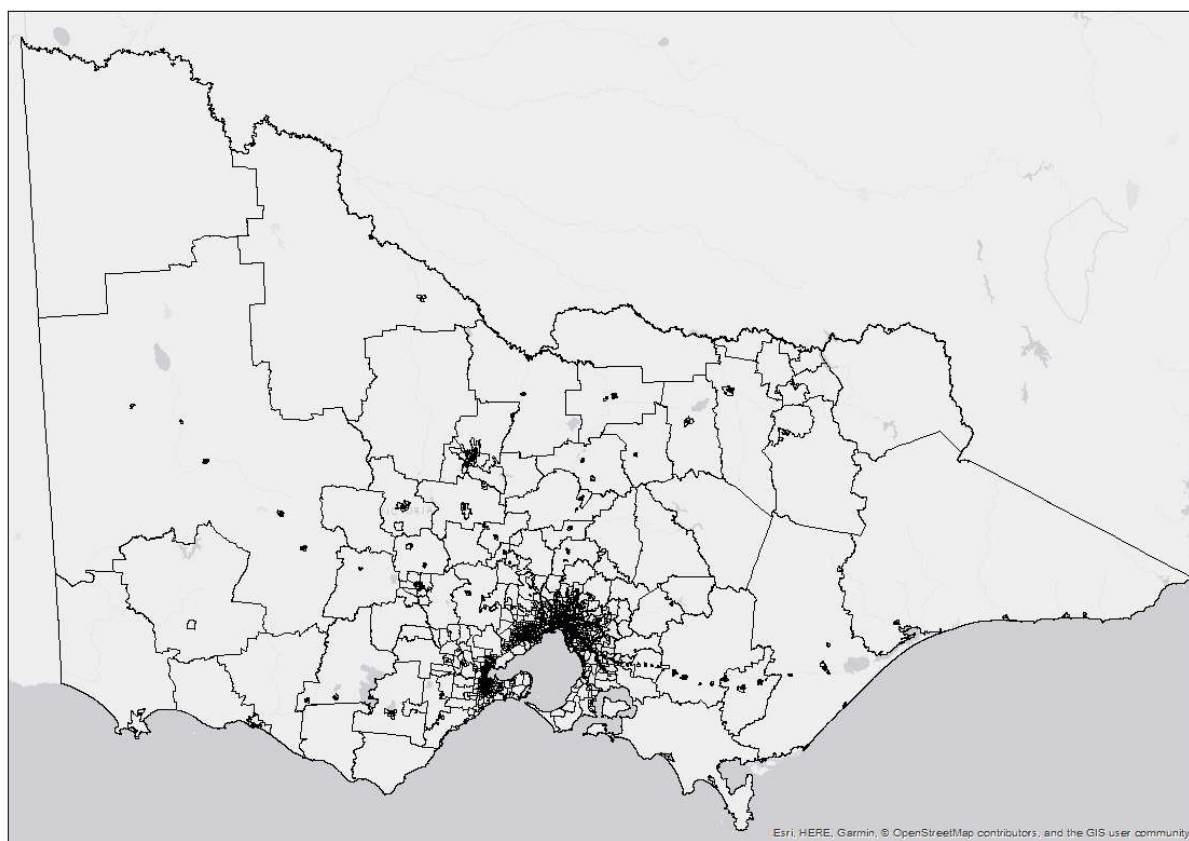
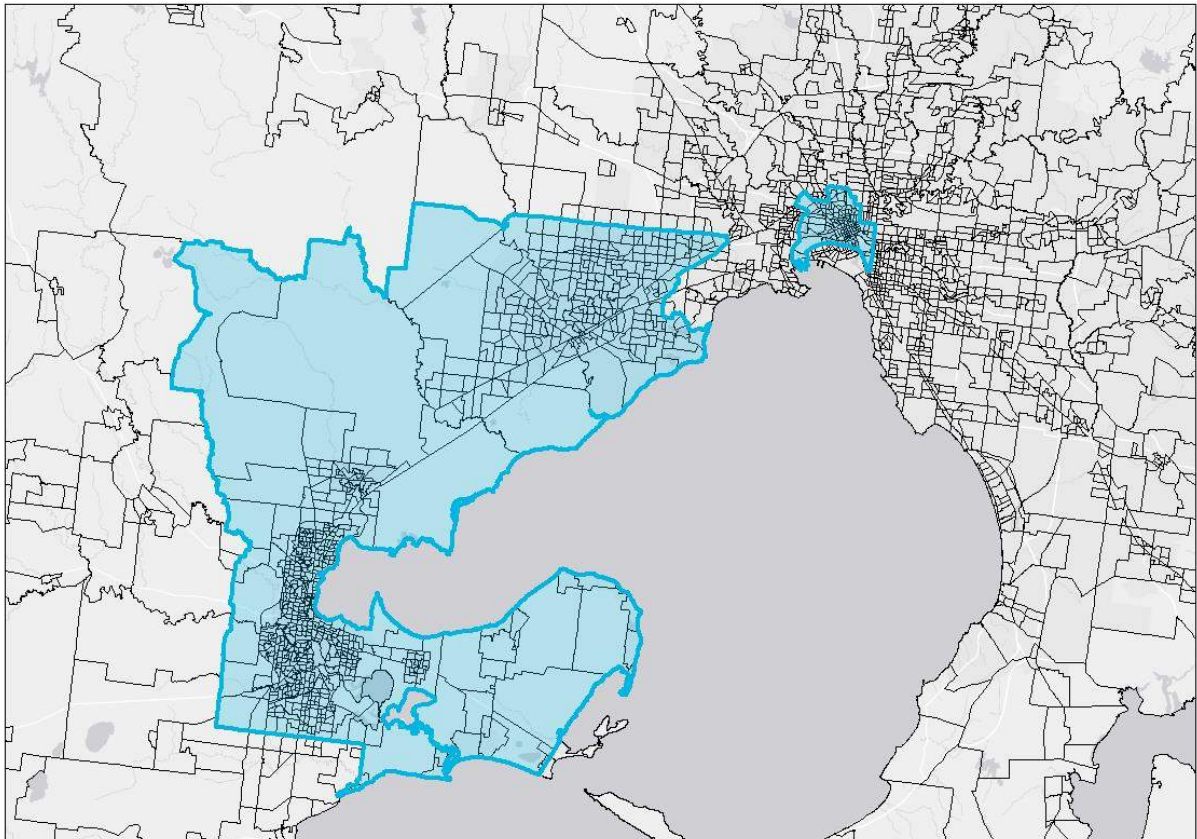


Figure 3: The transport zones across Melbourne, Wyndham and Geelong.



2.2.3 Study area

While the model covers the whole state of Victoria, the study area is focused on the Geelong railway corridor line stations at Lara, Corio, North Shore, North Geelong, Geelong, South Geelong, Marshall and Waurin Ponds. Model outputs of highway traffic volumes are focused within Greater Geelong Local Government Area (LGA).

The extent of the model study area is shown in Figure 4.

Figure 4 Model study area



2.3 Base and future year modelling

2.3.1 Base year modelling

A base year model of 2016 was provided to AECOM by TfV for use in this study. The methodology for using the base year model is described below.

2.3.1.1 Model review and checking

A review of the 2016 base model was carried out. The review included checking the road network coding within the study area, and the frequency of all train services between the Melbourne and Geelong corridor to ensure that the model inputs represent the existing road network and train services.

2.3.1.2 Model validation

The VITM provides the option to undertake model runs with public transport capacities either constrained or unconstrained. Imposing public transport constraints means that the VITM only allows public transport demands up to the capacity of the available services.

For model validation, the 2016 base year model was run using the option to constrain public transport capacity and to constrain train station park and ride parking capacity. The model validation was undertaken by comparing the model results against available observed data at two levels, global validation and local validation. The global validation considered the overall model performance in terms of public transport boardings by mode, and train loadings and boardings by line. The local validation has considered the model performance at the study area in terms of:

- Highway traffic volumes for the daily period by defined screenlines and
- Passenger boardings at railway stations for all time periods.

2.3.2 Future year modelling

The demand forecasting with the VITM will be undertaken for the future years of 2021, 2031 and 2041 using the TfV reference case network and land use inputs.

The reference case network was updated for this project with the approval of TfV. The updates were based on improvements that had previously been made to the Geelong Growth Area Transport Model network.

Scenario tests were developed to consider high population growth scenario provided by the City of Greater Geelong Council, and the impact of removing car parking at the Geelong Railway station.

The model inputs for future year modelling are outlined in Chapter 4.0.

3.0 2016 Base year model validation

3.1 Model validation guidelines

The model validation guidelines for this study are based on those provided by TfV for use in a regional rail study in completed in April 2017.

3.1.1 Validation priorities

The model validation guidelines recognise that some aspects of a model are more important than others in developing a model that is fit for purpose. For example, the guidelines may specify, depending on the type of project, that the validation of train loadings at the CBD cordon is very important, while the tram and bus boardings are of moderate importance. Consequently, the guidelines provide a ranking prioritisation of the validation elements, which would be used to assess the overall model performance at the conclusion. This ranking is shown in Table 1.

Table 1 Model validation guidelines prioritisation of validation elements

Ranking	Terminology	Presentation
1	Very important	Presented and explained in the body of the report
2	Important	
3	Moderate importance	Preferably presented in the appendix of the report
4	Low importance – check still within acceptable bounds of “global validation”	

3.1.2 Data quality and validation criteria

The model validation guidelines acknowledge that observed data available for model validation may have different grades of quality and provide different levels of confidence. The guidelines account for data quality by linking the desired validation criteria to the quality of the observed data. The quality of the data is subjectively assigned to one of four categories as summarised below:

1. ‘High quality’ data are complete datasets with little or no need for estimation. In the cases when estimation is necessary, the estimation includes no systematic bias and has a known level of error. It has an indicative desired criteria/accuracy of ± 10 percent.
2. ‘Good quality’ data has been collected for the purpose that it is being used. Errors are known and can be managed. It has an indicative desired criteria of between ± 5 percent and ± 15 percent.
3. ‘Representative’ data is data that has been derived from other data. It requires cross-checking to ensure its validity and the errors it contains cannot always be fully quantified. It has an indicative desired criteria of between ± 10 percent and ± 20 percent.
4. ‘Low quality’ data can provide perspective, but it should be used with caution as it can produce inexplicable trends. It has an indicative desired criteria of beyond ± 20 percent.

3.1.3 Quality of validation and modelled forecasts

A five-level ranking of validation quality is provided by the model guidelines. This ranking ranges from ‘Very good’ to ‘Poor’ with the purpose of providing a standardised comparison within and across models. The criteria and terminology of each of the five levels are described Table 2.

Table 2 Model validation guidelines – quality of validation levels

Level	Terminology	Criteria
1	Very good	At least good quality data and base year validation meets desired criteria for 80% of elements
2	Good	At least good quality data and base year validation meets desired criteria for 60% of elements
3	Satisfactory	At least good quality data and base year validation within range for majority of the highest priority items
4	Indicative	Complies with most global validation criteria and uses at least representative data
5	Poor	Model has not been validated against global criteria

3.1.4 Overall project assessment

The model validation guidelines state that the forecasting approach should be determined by the quality of the model validation. The forecasting approach recommended by the guidelines is shown in Table 3.

Table 3 Model validation guidelines – forecasting approach given quality of validation

Level	Terminology	Application in forecasting environment
1	Very good	Forecasts from the model scenarios can be used without adjustment. Out-of-model adjustments may be required if an aspect of the model is not satisfactory and is the focus of the model scenario.
2	Good	
3	Satisfactory	
4	Indicative	Base year observed data is grown by the growth forecast by the model. Alternatively, a different model is used.
5	Poor	

The following sections report the model validation based on the VITM 2016 base year constrained model run. The model was assumed to have constrained capacity for public transport vehicles and constrained parking capacity for park and ride vehicles at railway stations.

Section 3.2 presents the global validation which shows the performance of whole model by metropolitan and regional areas. Section 3.3 presents local validation results which focus on the boardings for railway stations, and screenlines of highway traffic volumes within the study area.

3.2 Global validation

This section presents a global validation of the model for the following components relevant to the study:

- Public transport boarding by time period.
- Metro and regional train loadings at the CBD cordon.
- Regional train loadings at the metropolitan boundary.
- Train boardings by lines and key stations.

Table 4 outlines the observed data that was used for the validation of public transport boarding and loading in this study. The data was provided by TfV.

Table 4 Observed public transport data quality

Period	Observed data
Metro Rail	High quality data from 2015 survey
Tram	High quality data from 2016
Bus	High quality data from 2016
V/Line	High quality data from November 2015 survey

3.2.1 Validation of public transport boarding by time period

Table 5 shows a comparison of public transport boardings by mode and time period between the modelled results and observed data. Under the assumption that the data can be classified as high quality, the model guidelines set the indicative desired criteria/accuracy of ± 10 percent.

Table 5 Public transport boardings (excluding interchanges) by time period

Mode	Time period	Observed	Modelled	Difference (%)	Desired criteria $\pm 10\%$
Metro Rail	AM	190,880	180,825	-5%	✓
	Inter Peak	177,676	210,308	18%	✗
	PM	230,457	233,035	1%	✓
	Off Peak	166,866	131,827	-21%	✗
	Daily	765,879	755,994	-1%	✓
Tram	AM	121,893	115,864	-5%	✓
	Inter Peak	228,242	226,643	-1%	✓
	PM	171,706	179,059	4%	✓
	Off Peak	130,543	129,996	0%	✓
	Daily	652,385	651,562	0%	✓
Bus (Metropolitan)	AM	96,658	75,966	-21%	✗
	Inter Peak	114,156	102,200	-10%	✓
	PM	125,312	110,740	-12%	✗
	Off Peak	85,336	49,421	-42%	✗
	Daily	421,462	338,328	-20%	✗
V/Line	AM	11,783	13,982	19%	✗
	Inter Peak	14,354	16,264	13%	✗
	PM	16,648	17,758	7%	✓
	Off Peak	10,345	6,682	-35%	✗
	Daily	53,130	54,687	3%	✓
Total public transport	AM	421,214	386,637	-8%	✓
	Inter Peak	534,428	555,415	4%	✓
	PM	544,123	540,592	-1%	✓
	Off Peak	393,090	317,926	-19%	✗
	Daily	1,892,856	1,800,571	-5%	✓

In general, the model performs well for Metro, V/Line and tram boardings, but underestimates bus boardings.

With regards to the modelled time periods, the model estimates satisfactorily for AM, Inter-peak and PM time periods but underestimates for the Off-peak modelled time period.

The overall model performance with respect to public transport boardings can be described as 'good'. The validation of V/Line travel is discussed further in this report.

Table 6 provides a summary of the model performance with respect to public transport boardings.

Table 6 Summary of PT boarding performance by mode

Measure	Performance
Desired criteria	±10%
Criteria met	15/25
Rating achieved	Good
Level of importance	Very important

3.2.2 Train loading validation

This section describes the model validation for train loadings. It compares model-estimated cordon loads to observed data.

3.2.2.1 Metro bound train loads at CBD cordon by line group

A cordon line was used to help understand how the model compares to observed train loads moving into and out of the CBD. Figure 5 shows the cordon locations.

Figure 5 CBD cordon locations

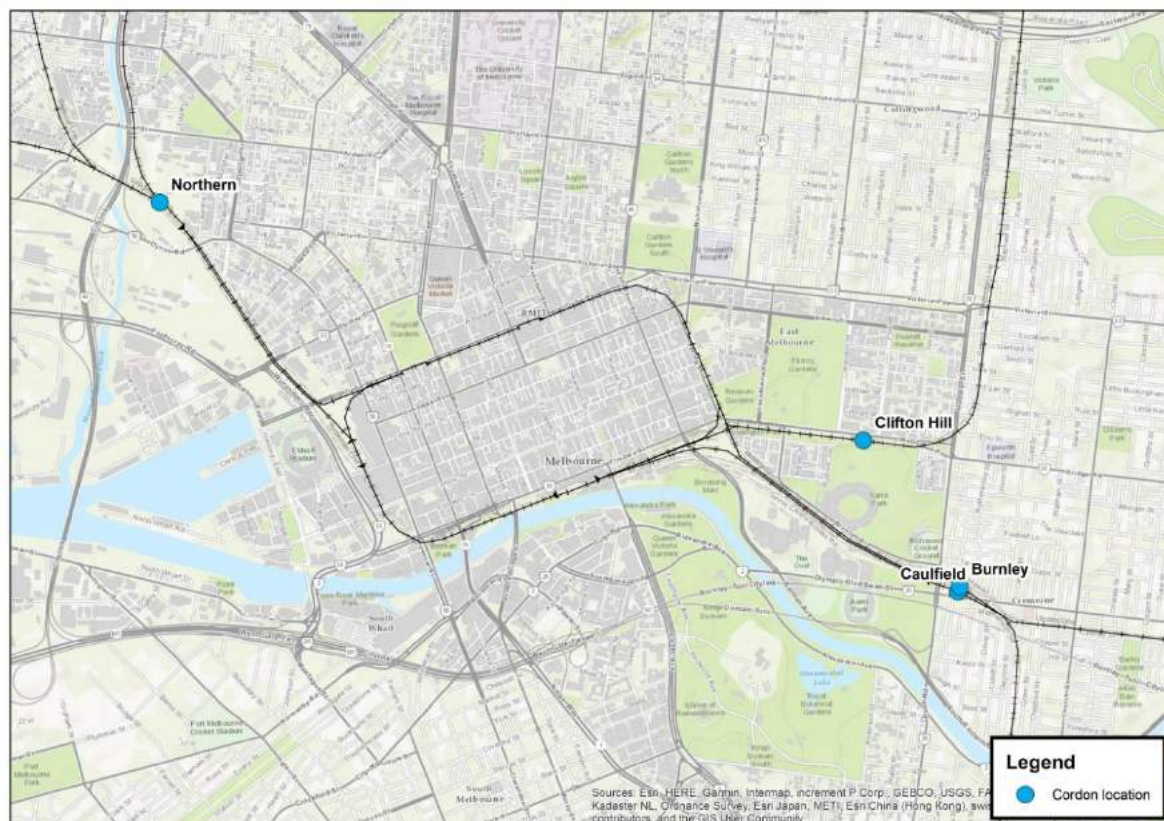


Table 7 and Table 8 show train loads at the CBD cordon during the AM and PM peaks respectively, by line group. As shown, the model meets the desired criteria of being within 10 percent for all metro groups and in total. Accordingly, the model is considered to have 'very good' performance for both the AM and PM peak train cordon loads.

The summary of metropolitan load performance by line group is shown in Table 9.

Table 7 AM peak train loads at CBD cordon by line group

Metro group	AM peak train loads at CBD cordon		Difference (%)	Desired criteria $\pm 10\%$
	Observed	Modelled		
Northern	45,639	42,009	-8%	✓
Clifton Hill	19,960	19,469	-2%	✓
Burnley	32,264	33,901	5%	✓
Caulfield	43,440	40,716	-6%	✓
Total	141,302	136,094	-4%	✓

Table 8 PM peak train loads at CBD cordon by line group

Metro group	PM peak train loads at CBD cordon		Difference (%)	Desired criteria $\pm 10\%$
	Observed	Modelled		
Northern	51,829	52,798	2%	✓
Clifton Hill	22,401	21,516	-4%	✓
Burnley	36,255	37,695	4%	✓
Caulfield	47,745	47,539	0%	✓
Total	158,230	159,548	1%	✓

Table 9 Summary of metropolitan load validation performance by line group

Measure	Performance
Desired criteria	$\pm 10\%$
Criteria met	10/10
Rating achieved	Very good
Level of importance	Very important

3.2.2.2 Metro bound train loads at CBD cordon by line

Table 10 and Table 11 show train loads at the CBD cordon during the AM and PM peaks respectively, by line. The model is considered to have 'good' performance for peak metropolitan train cordon loads measure by line as shown in Table 12.

Table 10 AM peak train loads at CBD cordon by line

Metro group	AM peak train loads at CBD cordon		Difference (%)	Desired criteria $\pm 15\%$
	Observed	Modelled		
Williamstown	3,381	3,120	-8%	✓
Werribee	12,725	9,540	-25%	✗
Sydenham	13,123	13,422	2%	✓
Craigieburn	12,182	13,174	8%	✓
Upfield	4,228	2,753	-35%	✗
South Morang	9,578	8,106	-15%	✗
Hurstbridge	10,382	11,362	9%	✓
Ringwood	21,255	21,444	1%	✓
Alamein	3,118	4,279	37%	✗
Glen Waverley	7,890	8,178	4%	✓
Dandenong	18,289	16,611	-9%	✓
Frankston	15,183	16,088	6%	✓
Sandringham	9,968	8,017	-20%	✗
Total	141,302	136,094	-4%	✓

Table 11 PM peak train loads at CBD cordon by line

Metro group	PM peak train loads at CBD cordon		Difference (%)	Desired criteria $\pm 15\%$
	Observed	Modelled		
Williamstown	3,641	4,526	24%	✗
Werribee	13,577	11,905	-12%	✓
Sydenham	15,105	16,069	6%	✓
Craigieburn	14,436	16,266	13%	✓
Upfield	5,070	4,033	-20%	✗
South Morang	10,887	8,917	-18%	✗
Hurstbridge	11,514	12,599	9%	✓
Ringwood	24,688	24,384	-1%	✓
Alamein	2,526	3,999	58%	✗
Glen Waverley	9,042	9,313	3%	✓
Dandenong	22,507	19,869	-12%	✓
Frankston	15,198	18,415	21%	✗
Sandringham	9,640	9,255	-4%	✓
Total	157,831	159,548	1%	✓

Table 12 Summary of metropolitan load validation performance by line

Measure	Performance
Desired criteria	$\pm 15\%$
Criteria met	18/28
Rating achieved	Good
Level of importance	Important

3.2.2.3 Validation of regional lines at CBD cordon

Table 13 below shows a comparison between observed and modelled train loads into the CBD. The model performs reasonably well for Geelong and Ballarat corridors but underestimates for the remaining regional areas. The comparison of inbound train loads shows that the model performance is 'satisfactory', as shown in Table 14.

Table 13 AM peak inbound (up) regional train loads at CBD cordon

V/Line group	AM peak train loads at CBD cordon		Difference (%)	Desired criteria ±15%
	Observed	Modelled		
Geelong	4,654	4,330	-7%	✓
Ballarat	2,769	2,979	8%	✓
Bendigo	1,157	749	-35%	×
Seymour	547	324	-41%	×
Traralgon	341	77	-77%	×
Total	9,468	8,460	-11%	✓

Table 14 Summary of regional train load validation at CBD cordon

Measure	Performance
Desired criteria	±15%
Criteria met	3/6
Rating achieved	Satisfactory
Level of importance	Very Important

3.2.2.4 Validation of regional lines at outer metropolitan boundary

Table 15 shows the observed and modelled regional train loads just outside the metropolitan boundary during the AM peak period. Table 16 follows with a summary of loads on the inside of the metropolitan boundary.

The comparison shows that the model estimates for the AM peak inbound train loads on the outside of the metropolitan boundary for Ballarat and Seymour lines are acceptable, within the desired criteria of 15 percent.

Inside of the metropolitan boundary, the model estimates for the inbound AM peak loads on the Ballarat and Traralgon lines are also acceptable.

Table 15 AM peak Inbound train loads outside the metropolitan boundary

V/Line lines	AM peak train loads outside MSD boundary		Difference (%)	Desired criteria ±15%
	Observed	Modelled		
Geelong	2,658	1,607	-40%	×
Ballarat	1,426	1,326	-7%	✓
Bendigo	1,163	811	-30%	×
Seymour	290	292	1%	✓
Traralgon	433	500	16%	×
Total	5,970	4,537	-24%	×

Table 16 AM peak Inbound train loads inside the metropolitan boundary

V/Line lines	AM peak train loads Inside MSD boundary		Difference (%)	Desired criteria $\pm 15\%$
	Observed	Modelled		
Geelong	3,421	2,406	-30%	×
Ballarat	2,572	2,496	-3%	✓
Bendigo	1,175	749	-36%	×
Seymour	503	393	-22%	×
Traralgon	448	500	12%	✓
Total	8,119	6,545	-19%	×

Overall, the model performance with respect to loads at the metropolitan boundary is considered as 'indicative', as shown in Table 17.

Table 17 Summary of regional train load validation at metropolitan boundary

Measure	Performance
Desired criteria	$\pm 15\%$
Criteria met	4/12
Rating achieved	Indicative
Level of importance	Important

3.2.3 Train boardings by time of day

3.2.3.1 By metro group

Table 18 shows the validation for each Metro line group by each time period and across the day. The desired target for validation is ± 15 percent. The target is met in 15 out of 25 elements (or 60%).

The model performance is summarised in Table 19, as shown it is classified as 'good' with respect to the metropolitan rail boardings by group.

Table 18 Boardings by line group by time period

Time period	Line group	Observed	Modelled	Difference (%)	Desired criteria ± 15
AM	Burnley	43,036	43,774	2%	✓
	Caulfield	55,475	55,515	0%	✓
	Clifton Hill	26,320	25,279	-4%	✓
	Northern	52,110	48,093	-8%	✓
	Inner Core	13,854	7,353	-47%	✗
IP	Burnley	28,371	43,023	52%	✗
	Caulfield	43,393	59,058	36%	✗
	Clifton Hill	16,940	22,586	33%	✗
	Northern	36,519	51,334	41%	✗
	Inner Core	52,242	33,267	-36%	✗
PM	Burnley	25,019	24,736	-1%	✓
	Caulfield	33,071	36,509	10%	✓
	Clifton Hill	12,786	13,505	6%	✓
	Northern	21,540	23,793	10%	✓
	Inner Core	137,905	134,104	-3%	✓
OP	Burnley	18,423	13,120	-29%	✗
	Caulfield	30,835	19,069	-38%	✗
	Clifton Hill	12,504	7,372	-41%	✗
	Northern	22,420	16,198	-28%	✗
	Inner Core	82,614	75,926	-8%	✓
Daily	Burnley	114,849	124,653	9%	✓
	Caulfield	162,774	170,151	5%	✓
	Clifton Hill	68,550	68,742	0%	✓
	Northern	132,589	139,418	5%	✓
	Inner Core	286,615	250,651	-13%	✓

Table 19 Summary of metropolitan boarding validation by group

Measure	Performance
Desired criteria	$\pm 15\%$
Criteria met	15/25
Rating achieved	Good
Level of importance	Important

3.2.3.2 By regional line sections

A summary of daily boardings for each regional line section is shown in Table 20. The desired accuracy for validation is ± 15 percent. As shown in Table 21, although the model performance for regional rail boardings overall is classified as 'indicative', its performance for Geelong line is satisfactory.

Table 20 Daily boardings for regional lines

Line	Line section	Daily boardings		Diff (%)	Desired criteria $\pm 15\%$
		Observed	Modelled		
Ballarat	Maryborough to Creswick	36	50	39%	x
Ballarat	Ararat to Wendouree	514	1,018	98%	x
Ballarat	Bacchus Marsh to Rockbank	3,189	5,097	60%	x
Ballarat	Ballarat to Ballan	2,170	1,556	-28%	x
Ballarat		5,909	7,721	31%	x
Bendigo	Echuca to Epsom	66	61	-7%	✓
Bendigo	Swan Hill to Eaglehawk	168	103	-39%	x
Bendigo	Bendigo to Clarkfield	4,134	3,067	-26%	x
Bendigo	Sunbury to Watergardens	465	799	72%	x
Bendigo		4,833	4,030	-17%	x
Core	Deer Park to Flinders Street	23,948	25,567	7%	✓
Geelong	Warrnambool to South Geelong	3,150	3,773	20%	x
Geelong	Geelong to Little River	4,189	4,792	14%	✓
Geelong	Wyndham Vale to Tarneit	4,157	3,014	-27%	x
Geelong		11,496	11,579	1%	✓
Seymour	Albury to Avenel	436	162	-63%	x
Seymour	Shepparton to Nagambie	253	462	83%	x
Seymour	Seymour to Heathcote Junction	1,181	662	-44%	x
Seymour	Wallan to Nth Melbourne	960	1,141	19%	x
Seymour		2,830	2,426	-14%	✓
Traralgon	Bairnsdale to Rosedale	311	312	0%	✓
Traralgon	Traralgon to Nar Nar Goon	2,869	1,433	-50%	x
Traralgon	Pakenham to Caulfield	934	1,046	12%	✓
Traralgon		4,114	2,790	-32%	x
Total V/Line boardings		53,130	54,114	2%	✓

Table 21 Summary of regional boarding validation by line section

Measure	Performance
Desired criteria	$\pm 15\%$
Criteria met	8/25
Rating achieved	Indicative
Level of importance	Important

3.2.3.3 Key metropolitan stations

A comparison between modelled and observed boardings at key metropolitan stations is shown in Table 22 with a desired accuracy of ± 25 percent.

The model performance is deemed as satisfactory as shown in Table 23.

Table 22 Train daily boardings at key metropolitan stations

Station	Metro train boardings		Difference (%)	Desired criteria $\pm 25\%$
	Observed	Modelled		
Flinders Street	90,559	73,716	-19%	✓
Southern Cross	76,998	68,204	-11%	✓
Footscray	18,999	10,050	-47%	x
North Melbourne	4,639	8,682	87%	x
Richmond	9,776	9,636	-1%	✓
Caulfield	13,355	8,124	-39%	x
Dandenong	8,041	7,160	-11%	✓
Sunbury	3,055	1,717	-44%	x
Sunshine	7,045	6,193	-12%	✓
Craigieburn	3,479	1,998	-43%	x
Pakenham	2,419	2,286	-6%	✓
Total	238,365	197,766	-17%	✓

Table 23 Summary of key metropolitan station boardings performance

Measure	Performance
Desired criteria	$\pm 25\%$
Criteria met	7/12
Rating achieved	Satisfactory
Level of importance	Important

3.2.3.4 Key regional stations

An outline of observed and modelled data for key stations on the V/Line is shown in Table 24.

The model was assessed to have 'satisfactory' performance, as is shown in Table 25.

Table 24 V/Line daily train boardings at key V/Line stations

Station	V/Line train boardings		Difference (%)	Desired criteria $\pm 25\%$
	Observed	Modelled		
Melton	2,215	3,804	72%	x
Bacchus Marsh	946	1,130	19%	✓
Ballarat	1,865	1,360	-27%	x
Gisborne	514	427	-17%	✓
Bendigo	1,275	768	-40%	x
Shepparton	193	300	55%	x
Traralgon	571	322	-44%	x
Wyndham Vale	1,526	1,469	-4%	✓
Tarneit	2,631	1,545	-41%	x
Geelong	2,081	2,396	15%	✓
Waurm Ponds	480	590	23%	✓
Total	14,826	14,234	-4%	✓

Table 25 Summary of key regional station boarding validation

Measure	Performance
Desired criteria	$\pm 25\%$
Criteria met	6/12
Rating achieved	Satisfactory
Level of importance	Important

3.3 Study area validation

This section provides a validation check for the model performance within the study area. It provides a comparison between the observed data and modelled results in terms of:

- Station boardings by modelled time period
- Highway traffic volumes at defined screenlines
- Travel times during AM peak

3.3.1 Station boardings

The TFV guidelines leave it to professional judgement to assess the performance of the model at station boardings by time period. For this assessment, rather than using the percentage difference as the validation criteria, the GEH statistic is used. The GEH statistic is a measure developed for validating highway traffic flows. This measure recognises that low flows tend to have a wider variance and are more difficult to model with a low percentage error.

The GEH statistic is calculated using the following equation:

$$GEH = \sqrt{\frac{2 \times (M - O)^2}{(M + O)}}$$

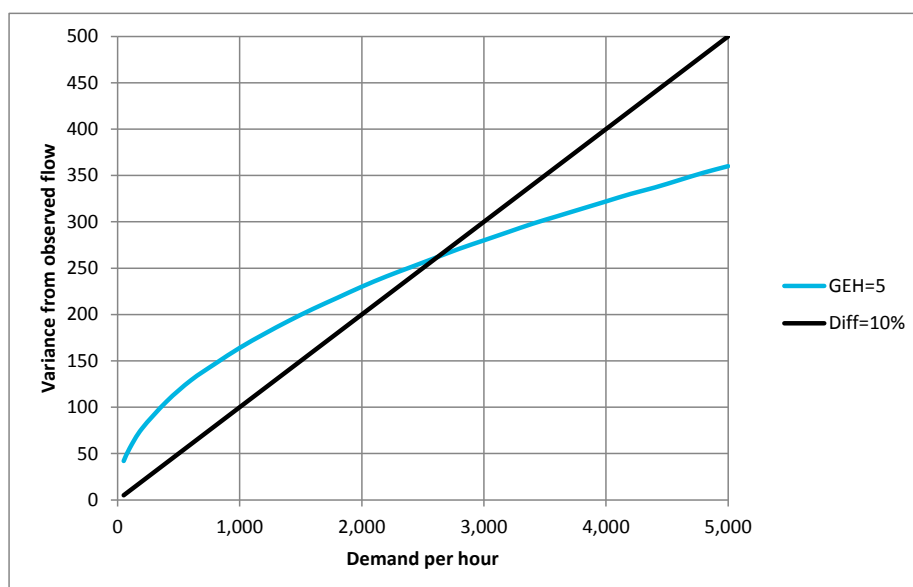
Where:

M = the modelled flow per hour

O = the observed flow per hour

Figure 6 demonstrates how the allowable variance differs when using a 10 percent error criterion and a criterion of GEH=5. This shows that the GEH=5 criterion allows greater than 10 percent variance for low flows (less than approx. 3,000 per hour), but the variance reduces below 10 percent for flows greater than 3,000 per hour.

Figure 6 GEH=5 and 10 percent error as absolute differences by magnitude of demand



Given the large variation in observed station boardings between stations, it was deemed sensible to use a measure such as the GEH statistic. However, it should be noted that the GEH statistic was designed to be used for validation in traffic models and it is not common practice to use this measure for validating public transport models. The station boardings by time period were converted to boardings per hour before the GEH is calculated.

For station boardings at daily level, it would be appropriate to continue using the % difference and compare against the desired target of ± 25 percent.

A comparison of observed and modelled data for all stations within Geelong for all time periods and daily volumes is shown in Table 26 for the four analysed time periods and Table 27 for the daily train boardings analysis.

The model was assessed to have 'good' performance, as is shown in Table 28.

Table 26 Train boardings by time period at stations within the study area

Time period	Station	V/Line train boardings		GEH	Desired criteria GEH<5
		Observed	Modelled		
AM	Lara	445	201	10	x
	Corio	13	157	11	x
	North Shore	28	322	16	x
	North Geelong	445	359	3	✓
	Geelong	528	480	2	✓
	South Geelong	783	430	10	x
	Marshall	333	342	0	✓
	Waurm Ponds	174	370	8	x
	Total	2,749	2,661	1	✓
IP	Lara	252	201	1	✓
	Corio	13	57	3	✓
	North Shore	34	63	2	✓
	North Geelong	272	265	0	✓
	Geelong	630	701	1	✓
	South Geelong	502	1,005	7	x
	Marshall	151	87	2	✓
	Waurm Ponds	182	116	2	✓
	Total	2,036	2,493	4	✓
PM	Lara	97	65	2	✓
	Corio	21	125	7	x
	North Shore	21	72	4	✓
	North Geelong	87	188	5	✓
	Geelong	441	843	9	x
	South Geelong	141	747	17	x
	Marshall	44	74	2	✓
	Waurm Ponds	51	77	2	✓
	Total	903	2,191	19	x
OP	Lara	141	42	4	✓
	Corio	11	39	2	✓
	North Shore	27	27	0	✓
	North Geelong	168	58	4	✓
	Geelong	482	372	2	✓
	South Geelong	220	211	0	✓
	Marshall	84	64	1	✓
	Waurm Ponds	73	28	3	✓
	Total	1,206	842	5	✓

Table 27 Daily train boardings at stations within the study area

Time period	Station	V/Line train boardings		Difference (%)	Desired criteria $\pm 25\%$
		Observed	Modelled		
Daily	Lara	935	508	-46%	x
	Corio	58	378	552%	x
	North Shore	110	484	340%	x
	North Geelong	972	870	-10%	✓
	Geelong	2,081	2,396	15%	✓
	South Geelong	1,646	2,394	45%	x
	Marshall	612	567	-7%	✓
	Waurm Ponds	480	590	23%	✓
	Total	6,894	8,188	19%	✓

Table 28 Summary of key regional station boarding validation

Measure	Performance
Desired criteria	GEH<5 (time period boardings); $\pm 25\%$ (daily boardings)
Criteria met	31/45
Rating achieved	Good
Level of importance	Important

Table 29 shows a comparison of the access mode share for the stations within the study area. The observed mode shares were collected during 6:00AM-9:30AM, while the modelled AM peak is between 7:00-9:00AM. The observed data was collected by an intercept survey of a sample of travellers using the stations. In the observed data, car access mode includes car drivers, car passengers by kiss and ride and car passengers by park and ride. The walk access mode includes walking and cycling.

Table 29 Comparison of station access mode share in AM period

Station	Observed 2018			Modelled		
	Walk	Bus	Car	Walk	Bus	Car
Lara	15%	11%	74%	22%	0%	78%
Corio	Not surveyed			18%	5%	77%
North Shore	49%	8%	43%	11%	1%	88%
North Geelong	15%	8%	78%	11%	1%	88%
Geelong	12%	38%	50%	10%	28%	62%
South Geelong	16%	4%	80%	14%	16%	70%
Marshall	21%	7%	72%	8%	0%	92%
Waurm Ponds	14%	9%	77%	18%	1%	81%
Total	16%	14%	70%	13%	8%	79%

It can be seen that overall the model represents reasonably well the pattern of access modes with the highest mode share being the car, then walking and the lowest mode share being the bus.

3.3.2 Highway traffic volume validation

The highway validation is based on the VicRoads traffic count database collected at 20 sites located within the study area. The traffic counts are arranged into three screenlines: North Geelong, South Geelong and East West to capture north-south and east-west traffic movements through the study area. Figure 7 shows the location of traffic screenlines.

Table 30 provides the traffic count locations for each screenline.

Figure 7 Traffic screenline locations



Table 30 Highway validation locations and HMGNS flow ID

ID	HMGNS Flow ID	Location
Geelong North Screenline		
1	10968	Seabeach Parade Btw Corio Quay Road And Lowe Street
2	10269	Station Street Btw North Shore Road And St Georges Road
3	14579	Melbourne Road (Princes Hwy) Btw The Boulevard And St Georges Road
4	10508	Thompson Road Btw Morgan Street And Cox Road
5	15525	Geelong Ring Road Btw Midland Highway And Anakie Road
6	11890	Anakie Road Btw Separation Street And Coakley Crescent
Geelong South Screenline		
7	15236	Geelong Ring Road Btw Geelong Ring Road (Stage 4A) And Princes Highway West
8	7812	Colac Road Btw Settlement Road And Pioneer Road
9	250	Surf Coast Highway Btw Settlement Road And Pioneer Road
10	1344	Barwon Heads Road Btw Breakwater Road And Geelong-Barwon Heads Road
Geelong East West Screenline		
11	15127	Geelong Ring Road Btw Bacchus Marsh Road And Anakie Road
12	3250	Cox Road Btw Belmont-Corio Road And Thompson Road
13	5142	Morgan Street Btw Thompson Road And The Boulevard
14	15644	Separation Street Btw Dunn Street And Corio-Waurn Ponds Road
15	12641	Church Street Btw Pakington Street And Ballarat Road
16	8527	Aberdeen Street Btw Pakington Street And Shannon Avenue
17	10254	West Fyans Street Btw Latrobe Terrace And Pakington Street
18	13104	Mt Pleasant Road Btw High Street And The Avenue
19	6858	Roslyn Road Btw North Valley Road And Corio Street
20	7226	Settlement Road Btw Surf Coast Highway And Colac Road

Table 31 outlines the highway validation results for the daily traffic volumes in the inbound and outbound directions of each screenline.

Table 31 Daily traffic validation

ID	Location	Observed	Modelled	Difference (%)	Desired criteria $\pm 20\%$
Geelong North screenline - north bound					
1	Seabeach Parade	2,132	1,007	-53%	×
2	Station Street	2,979	1,335	-55%	×
3	Melbourne Road	21,663	20,445	-6%	✓
4	Thompson Road	6,405	4,491	-30%	×
5	Geelong Ring Road	14,913	18,744	26%	×
6	Anakie Road	4,069	4,409	8%	✓
	Total	52,161	50,431	-3%	✓

ID	Location	Observed	Modelled	Difference (%)	Desired criteria $\pm 20\%$
Geelong North screenline - south bound					
1	Seabeach Parade	2,132	907	-57%	×
2	Station Street	2,868	1,409	-51%	×
3	Melbourne Road	21,663	20,936	-3%	✓
4	Thompson Road	6,277	4,454	-29%	×
5	Geelong Ring Road	14,750	19,402	32%	×
6	Anakie Road	4,828	4,762	-1%	✓
	Total	52,518	51,872	-1%	✓
Geelong South screenline - south bound					
7	Geelong Ring Road	13,089	10,043	-23%	×
8	Colac Road	13,518	12,255	-9%	✓
9	Surf Coast Highway	16,723	17,800	6%	✓
10	Barwon Heads Road	9,128	7,563	-17%	✓
	Total	52,458	47,661	-9%	✓
Geelong South screenline - north bound					
7	Geelong Ring Road	12,842	10,748	-16%	✓
8	Colac Road	13,368	9,196	-31%	×
9	Surf Coast Highway	16,246	18,739	15%	✓
10	Barwon Heads Road	10,258	8,264	-19%	✓
	Total	52,714	46,947	-11%	✓
East West screenline - east bound					
11	Geelong Ring Road	14,913	17,118	15%	✓
12	Cox Road	6,351	3,101	-51%	×
13	Morgan Street	1,900	1,680	-12%	✓
14	Separation Street	4,951	4,906	-1%	✓
15	Church Street	13,405	14,299	7%	✓
16	Aberdeen Street	7,254	6,585	-9%	✓
17	West Fyans	5,400	5,924	10%	✓
19	Roslyn Road	3,300	4,026	22%	×
20	Settlement Road	9,776	11,356	16%	✓
	Total	90,810	82,350	-9%	✓
East West screenline - west bound					
11	Geelong Ring Road	14,750	17,092	16%	✓
12	Cox Road	7,029	3,722	-47%	×
13	Morgan Street	1,900	1,680	-12%	✓
14	Separation Street	1,900	1,802	-5%	✓
15	Church Street	12,464	15,269	23%	×
16	Aberdeen Street	7,348	6,272	-15%	✓
17	West Fyans	7,986	5,449	-32%	×
18	Mt Pleasant Road	4,500	4,483	0%	✓
19	Roslyn Road	3,300	4,026	22%	×
20	Settlement Road	9,663	11,338	17%	✓
	Total	87,690	79,396	-9%	✓

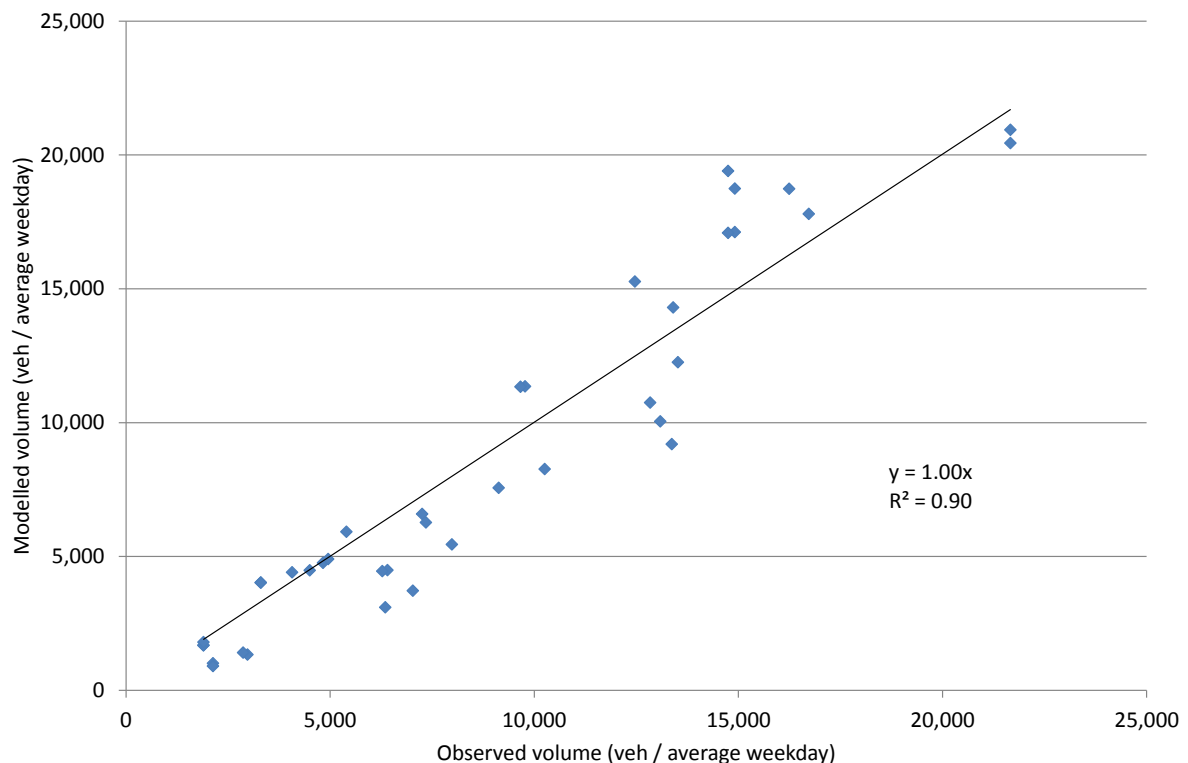
Although there are some individual roads with high percentage of difference, the total modelled traffic volumes for the defined screenlines are mostly within 10% of the observed traffic counts. This means the model estimates well traffic demand between regions, but the distribution of traffic between individual routes could be further improved. However, since the focus of this study is to determine public transport passenger travel demand by access mode, some variations in highway traffic volumes should not affect the accuracy of public transport demand forecast. Table 32 shows a summary of the traffic volume validation, as shown it is classified as 'good'.

Table 32 Summary of highway traffic validation

Measure	Performance
Desired criteria	±20%
Criteria met	30/45
Rating achieved	Good
Level of importance	Important

Figure 8 shows a scatter plot of the daily (24-hour) observed and modelled traffic volumes for individual sites. As can be seen, the slope of the line of best fit is 1.00 (which is between 0.9 and 1.1) and the statistical correlation (R^2) is 0.90 (which is greater than 0.85). These measures of goodness of fit satisfy standard validation criteria.

Figure 8 Comparison between modelled and observed daily traffic volumes



Overall, the model was deemed to have a 'good' performance', as is shown in Table 32 and Figure 8.

3.3.3 Travel times by public transport and car for the AM peak

Model travel times were compared to observed travel times along corridors that are important for the project. For this comparison, observed times for car were obtained using the Google Maps route finder tool, and the departure time was input into Google Maps as 8:00am. For car travel, Google provides a

range of 'typical' travel times. While Google information is not a standard measure of travel time, but in the absence of travel time survey, it provides a reasonable indication for checking the model travel times.

A range of observed travel times for public transport was drawn from the Journey Planner website of PTV. Scheduled train journey times between station pairs were extracted for departure times close to 8:00 am within the 7:00 am to 9:00 am period.

Table 33 and Table 34 below outline a comparison between travel time, in minutes, by public transport and by car for specific routes respectively.

Table 33 Travel times by car in the AM peak

Origin	Destination	Car travel time (in min)		Difference (%) to obs. mean	Comment
		Observed	Modelled		
Torquay	Geelong	22-35	20	-30%	Underestimated
Geelong	Southern cross	60-100	90	13%	Good, within the range
Anglesea	Southern cross	80-110	110	11%	Good, within the range
Geelong	Bannockburn	24-28	24	-8%	Good, within the range
Geelong	Drysdale	24-30	24	-11%	Good, within the range

Table 34 Travel times by public transport in the AM peak

Origin	Destination	PT travel time (in min)		% Diff to Obs. mean	Comment
		Observed	Modelled		
Wauron Ponds	Geelong	13-14	11	-18%	Underestimated
Geelong	Sothorn cross	58-68	72	14%	Satisfactory
Wauron Ponds	Sothorn cross	73-78	83	10%	Good

The guidelines specify that professional judgment should be used to assess the model validation. The modelled travel time for a route is deemed as satisfactory if it is within the range of observed travel times or its difference against the mean observed travel time is within 15%. The performance of the model is deemed to be 'satisfactory'.

3.4 2016 VITM base modelling summary and conclusions

3.4.1 Summary 2016 base model performance

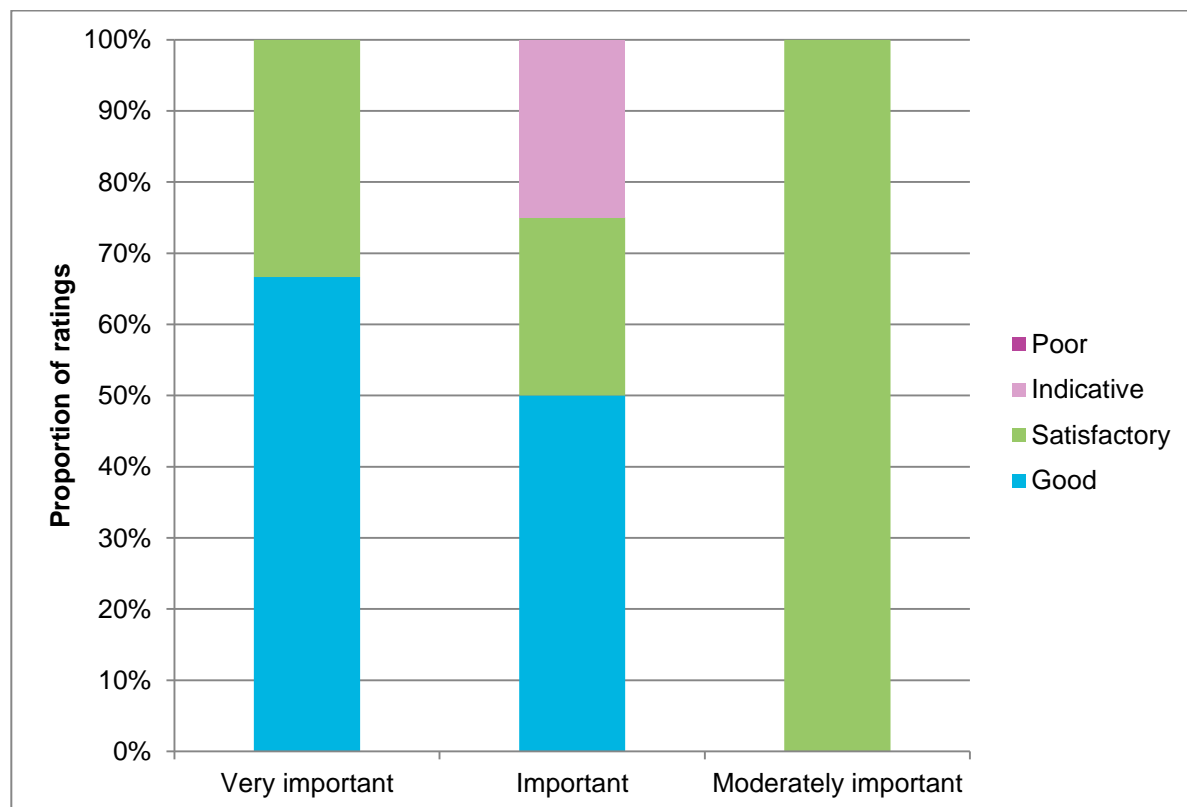
Table 35 provides a summary of the model performance for the different validation measures assessed for the 2016 base VITM model for use in the Geelong Commuter Car Parking Strategy study.

Figure 7 provides the summary validation information in graphical form. This indicates that the model performs at 'satisfactory' or 'good' level for all the very important measures, 75 percent of the important measures, and all of the moderately important measures.

Table 35 Summary of validation performance

Measure	Level of importance	Rating
Public transport boardings by mode	Very important	Good
Metropolitan rail CBD cordon loads by line group	Very important	Good
Metropolitan rail CBD cordon loads by line	Important	Good
Regional rail CBD cordon loads by line	Very important	Satisfactory
Regional rail metropolitan border cordon loads by line	Important	Indicative
Metropolitan rail boardings by line group	Important	Good
Regional rail boardings by line sections	Important	Indicative
Key metropolitan rail station boardings	Important	Satisfactory
Key regional rail station boardings	Important	Satisfactory
Study Area - Station boardings	Important	Good
Study Area - Highway traffic volumes	Important	Good
Study Area - Travel times by mode	Moderately important	Satisfactory

Figure 9 Summary of model performance by level of importance



3.4.2 2016 Base model conclusions

As a strategic model, as expected the VITM performs better at strategic levels, such as boardings by mode and by time period, rather than at individual lines and stations. The model also performs better for metro lines than regional lines. The model performance for regional lines could be improved by reviewing the regional network and transit line coding.

At the study area, the model performance on both public transport and highway traffic volumes are good. This is important for the study to provide confidence to use the model to provide demand forecasts by transport mode for future years for the study area.

Overall, the model has performed at a satisfactory level for more than 70 percent of all measures rated 'moderately important' to 'very important'. It is therefore concluded that the model is fit for use to inform the Geelong Commuter Car Parking Strategy.

4.0 Future year models

4.1 Introduction

The previous chapter presented the model validation for the 2016 base year and provides confidence for its application to provide travel mode demand forecasts for future years.

TfV provided the reference VITM models for future years 2021, 2031 and 2041, together with necessary inputs such as demographic data, road network and public transport (PT) service plans. In addition, the City of Greater Geelong (CoGG) provided information relating to high population growth and corresponding future year road networks as part of the scenario testing component.

This chapter firstly presents the key input data, including demographic data, road network and PT service plans. It then describes the scenarios to be tested, and finally presents the modelling results.

4.2 Future year demographic data

4.2.1 Reference demographic data from TfV

The most recent demographic data projections developed by SGS Economics were provided by TfV and used for this study. The data was developed to reflect 2016 Census data, align to VIF 2018 projections, and revise growth distribution to better reflect current planning. These enhancements were undertaken within Geelong only as outside of Geelong the data still matches the original (2018) reference case land use data.

The land use data was developed using a disaggregated system comprised of 20,390 zones, allowing for very fine spatial distribution of data. For modelling purposes, the land use information was transformed in two steps as follows:

- The first step involved aggregating the 20,390 zones to 6,973 zones, and was undertaken externally outside the model, with the 6,973 zone data used as a basis input for all VITM model runs. The transformation from 20,390 to 6,973 is based on land mass distribution which allows for a reasonable redistribution across the entire state.
- The second step transformation of 6,973 zones into 2,988 zones was handled internally within the VITM model to speed up model run time.

Figure 10 shows the boundary and location of SA2 within the Geelong SA4.

Table 36 shows the population, employment and educational enrolments within the Geelong Statistical Division (SA4), divided by smaller SA2 areas. In 2016 there were 283,000 people residing in Geelong, which is expected to grow to 447,700 people by 2041, representing an average compound growth rate of 1.9% per annum.

Table 37 and Table 38 show a comparison of the same population, employment and enrolment parameters, between Geelong and other Victorian cities for the same period. Generally, the population growth rate in Geelong is forecast to be slightly higher than in Bendigo, Ballarat and Melbourne. The expected employment growth rate for Geelong is also higher than the two regional cities, but lower than that of Melbourne. However, the growth of educational enrolment for Geelong is comparable to the other cities.

Figure 11 to Figure 14 show the expected population distributions in the Geelong area (using TfV land use data) for 2016, 2021, 2031 and 2041 respectively. Population density is displayed where one dot represents 25 people, and a greater number of dots indicates higher density. Similarly, Figure 15 to Figure 18 depict the expected employment density in Geelong for 2016, 2021, 2031 and 2041.

Figure 10 SA2 within Geelong SA4

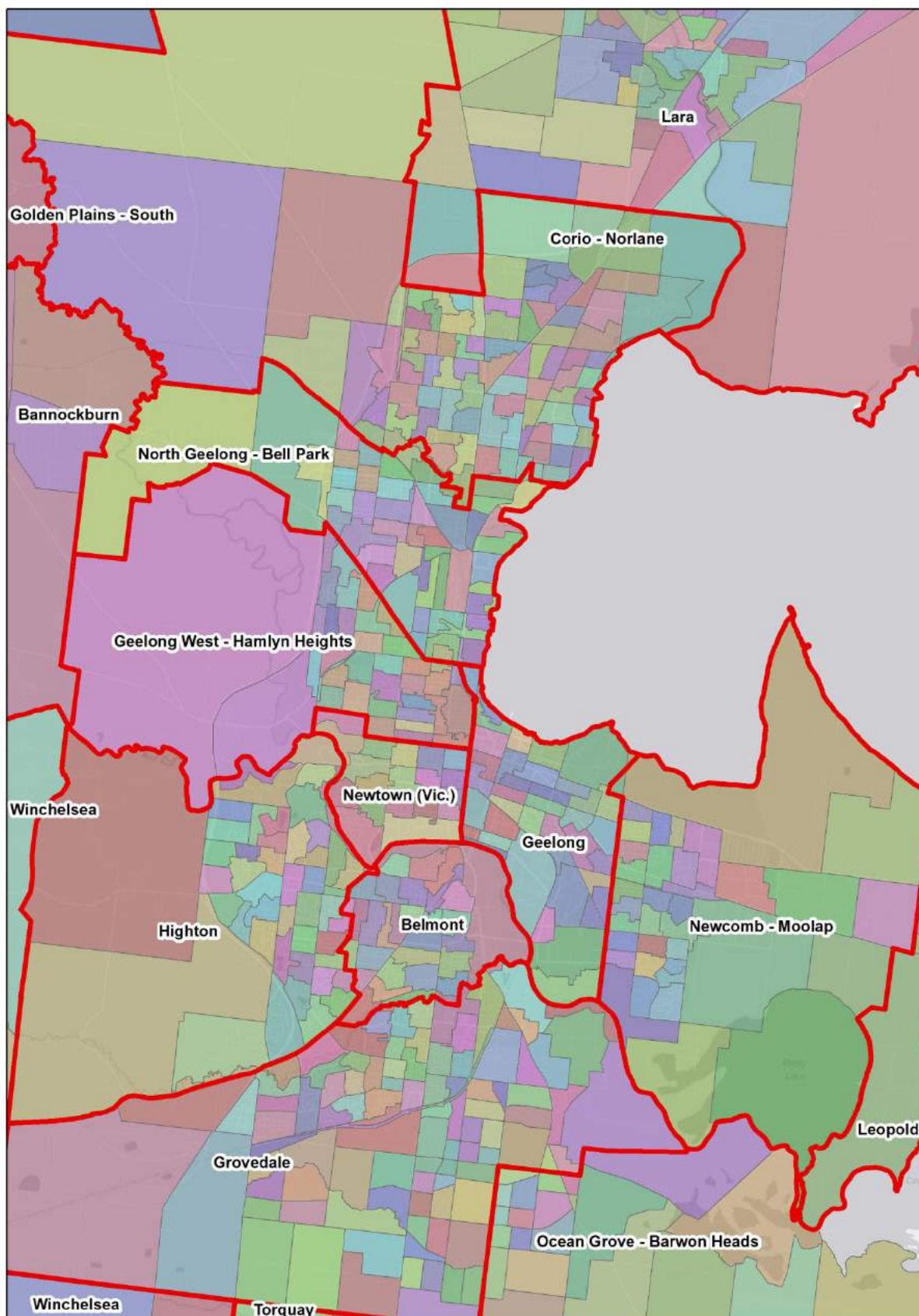


Table 36 Future year demographics for Geelong SA4 summarised by SA2 areas

SA2 Areas	Population				Employment				Enrolment			
	2016	2021	2031	2041	2016	2021	2031	2041	2016	2021	2031	2041
Bannockburn	6,000	7,500	10,700	13,900	1,500	1,700	2,200	2,800	600	800	1,100	1,500
Golden Plains - South	6,800	7,300	8,500	9,800	2,600	2,400	2,500	2,700	700	600	800	1,000
Leopold	12,600	14,400	17,100	19,000	1,500	1,600	2,000	2,500	800	1,000	1,500	1,700
Newcomb - Moolap	15,000	15,300	15,900	16,600	5,300	5,600	6,300	7,100	1,100	1,000	1,000	1,000
Lara	18,600	21,400	26,400	31,500	6,600	6,800	7,400	8,200	2,300	2,500	2,900	3,500
Corio - Norlane	26,900	27,800	29,900	38,200	8,400	8,700	9,500	10,400	4,100	4,200	4,400	5,300
North Geelong - Bell Park	15,100	16,300	18,200	20,700	12,000	12,500	13,600	14,800	4,300	4,500	4,800	5,600
Geelong West - Hamlyn Heights	19,700	20,800	23,400	28,800	5,700	6,300	7,400	8,800	3,500	3,700	4,400	4,900
Geelong	13,000	13,700	15,000	16,800	34,600	37,200	43,000	49,700	23,200	25,500	29,900	34,100
Portarlington	7,400	8,200	9,200	10,000	1,100	1,300	1,500	1,800	300	300	200	200
Clifton Springs	14,100	16,500	19,400	22,200	3,100	3,500	4,400	5,100	4,000	4,600	5,000	5,100
Point Lonsdale - Queenscliff	4,000	3,900	4,000	4,100	2,300	2,500	3,100	3,700	300	300	300	400
Ocean Grove - Barwon Hds	23,400	29,900	41,200	49,200	5,400	6,200	8,100	9,800	2,100	2,900	4,000	4,400
Newtown (Vic.)	10,500	11,100	12,000	13,100	4,500	5,000	5,800	6,600	9,300	10,100	11,300	12,300
Highton	23,000	24,600	27,700	29,700	6,000	7,500	9,100	10,500	18,200	21,500	27,300	30,800
Belmont	14,000	14,500	15,400	16,400	5,700	6,200	7,200	8,400	2,900	3,700	4,300	4,800
Grovedale	23,800	31,700	47,000	61,200	6,800	8,400	14,300	21,900	2,900	3,700	6,000	8,000
Torquay	18,600	21,800	28,300	35,000	6,000	6,800	8,600	10,200	2,600	3,200	3,800	4,700
Winchelsea	5,700	5,700	6,100	6,500	2,800	2,700	3,100	3,600	500	500	500	500
Lorne - Anglesea	4,800	4,600	4,800	5,000	2,700	3,000	3,700	4,200	400	300	300	400
Total	283,000	317,000	380,200	447,700	124,600	135,900	162,800	192,800	84,100	94,900	113,800	130,200

Table 37 Future year demographics comparison of Geelong, Victoria and Melbourne

Total Growth	Population				Employment				Enrolment			
	2016	2021	2031	2041	2016	2021	2031	2041	2016	2021	2031	2041
Geelong SA4	283,000	317,000	380,200	447,700	124,600	135,900	162,800	192,800	84,100	94,900	113,800	130,200
Ballarat	158,093	170,655	198,205	226,186	68,840	71,942	82,699	92,792	12,150	14,355	18,912	21,609
Bendigo	151,800	164,311	190,199	216,730	69,101	73,063	84,094	93,851	12,929	14,323	17,180	19,602
Melbourne SA4	4,331,913	4,796,413	5,719,499	6,641,145	2,249,992	2,489,662	3,074,599	3,632,885	1,124,934	1,257,609	1,544,026	1,732,993
Victoria	6,048,819	6,605,809	7,735,616	8,881,017	3,019,084	3,274,756	3,953,322	4,601,664	1,509,814	1,661,920	1,993,919	2,230,736

Table 38 Future year demographic growth comparison

Total Growth	Population			Employment			Enrolment		
	2016-2021	2021-2031	2031-2041	2016-2021	2021-2031	2031-2041	2016-2021	2021-2031	2031-2041
Geelong SA4	2.30%	1.83%	1.65%	1.75%	1.82%	1.71%	2.45%	1.83%	1.36%
Ballarat	1.54%	1.51%	1.33%	0.89%	1.40%	1.16%	3.39%	2.80%	1.34%
Bendigo	1.60%	1.47%	1.31%	1.12%	1.42%	1.10%	2.07%	1.84%	1.33%
Melbourne SA4	2.06%	1.78%	1.51%	2.05%	2.13%	1.68%	2.25%	2.07%	1.16%
Victoria	1.78%	1.59%	1.39%	1.64%	1.90%	1.53%	1.94%	1.84%	1.13%

Figure 11 2016 Population density

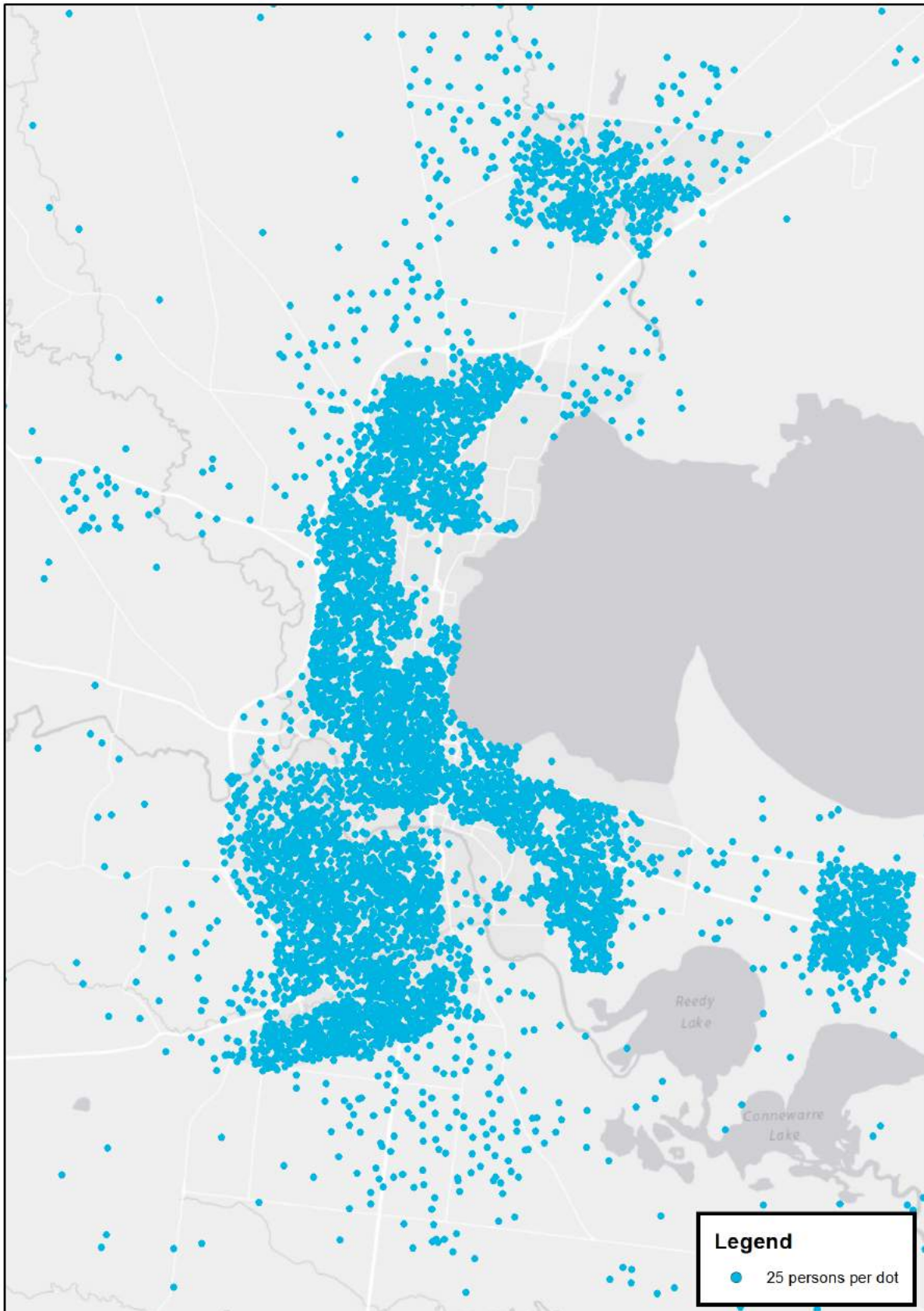


Figure 12 2021 Population density

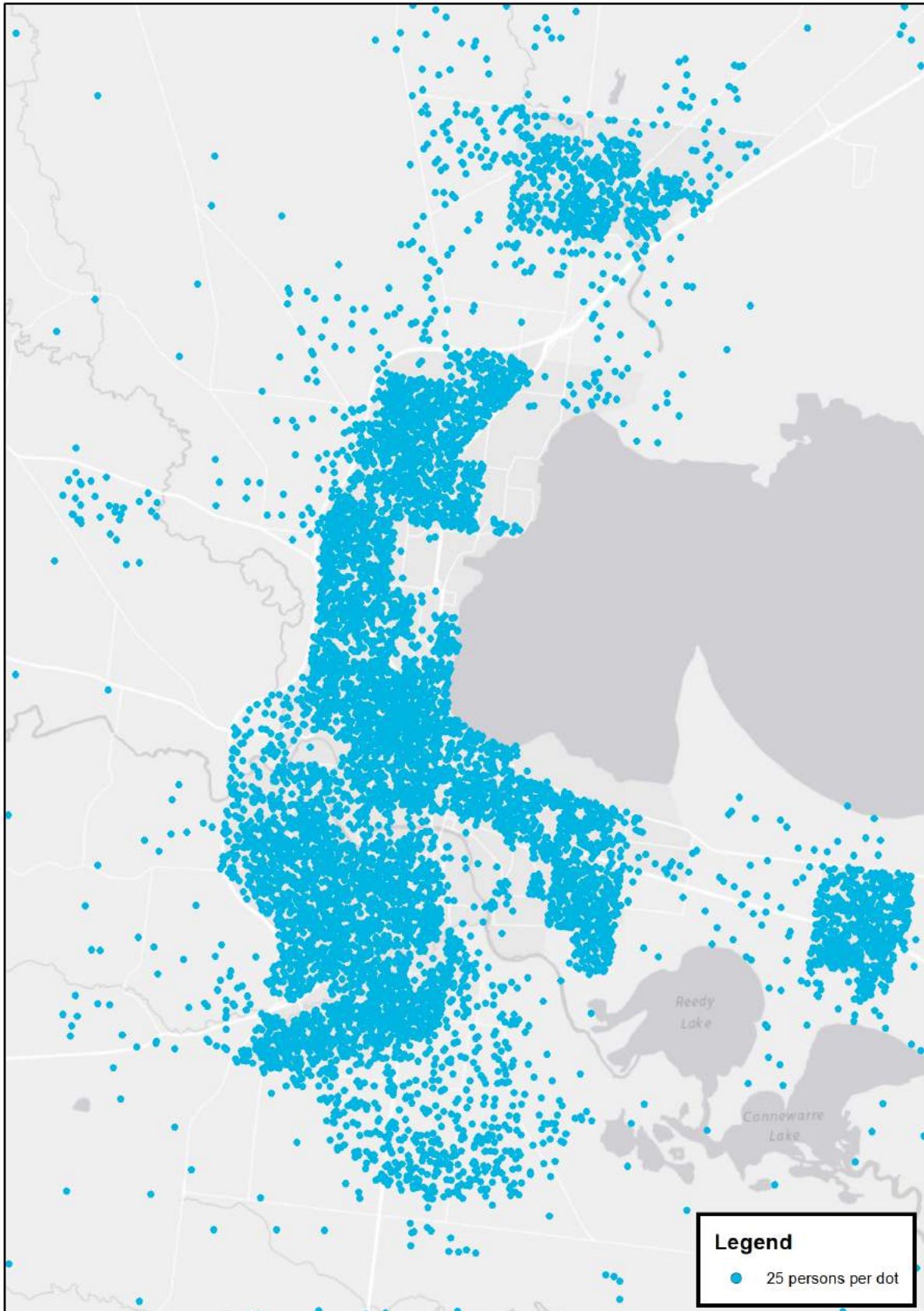


Figure 13 2031 Population density

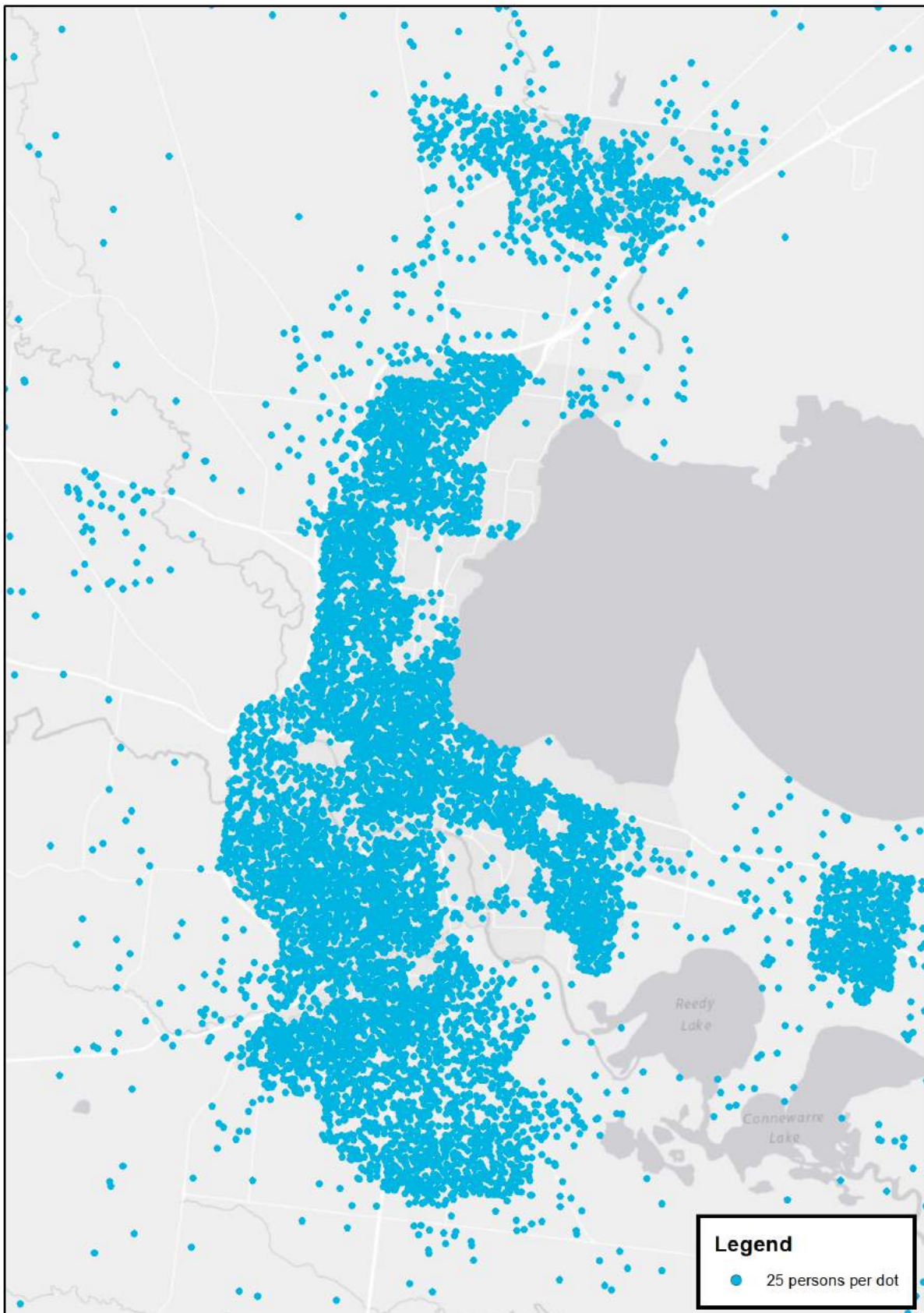


Figure 14 2041 Population density

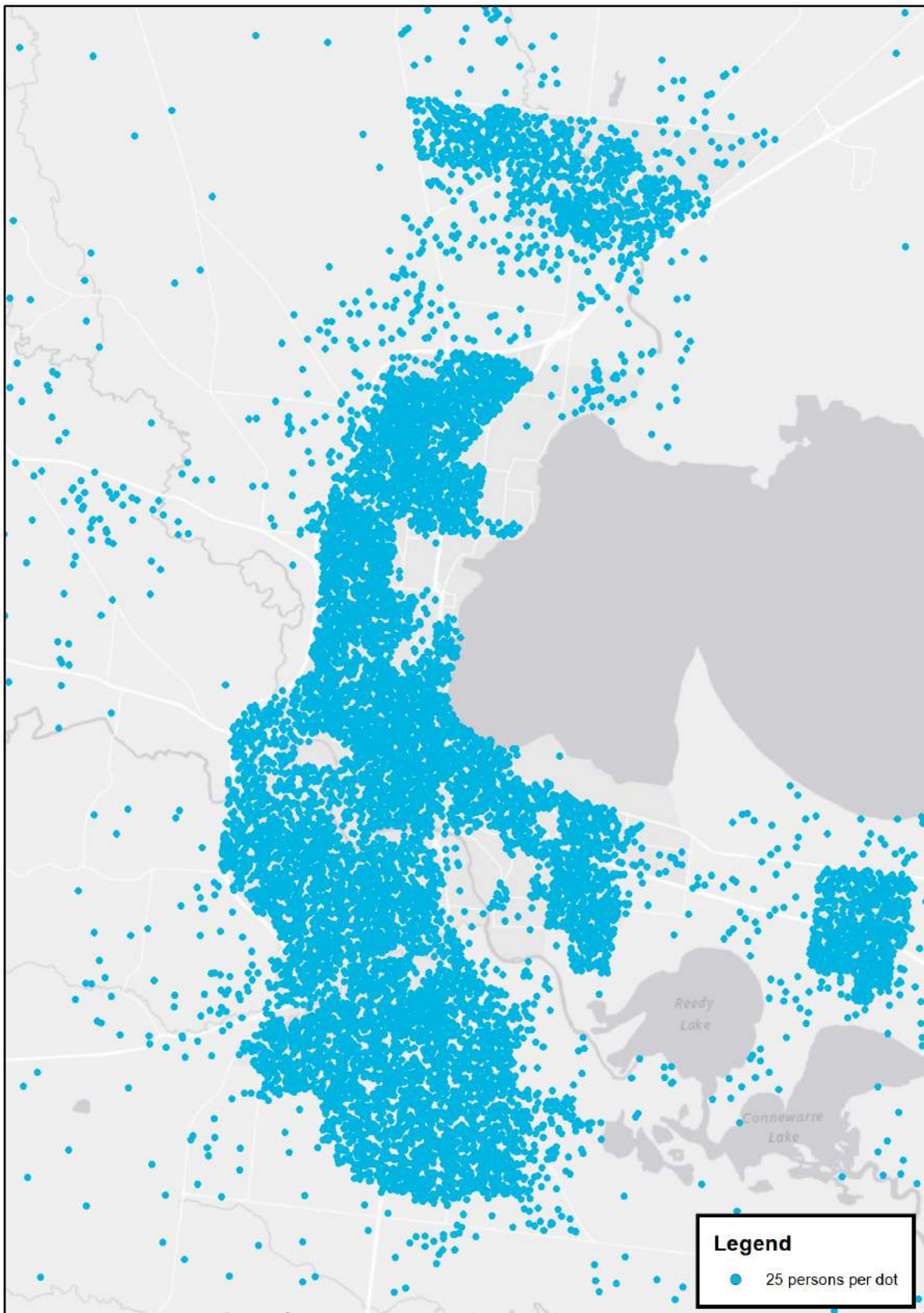


Figure 15 2016 Employment density

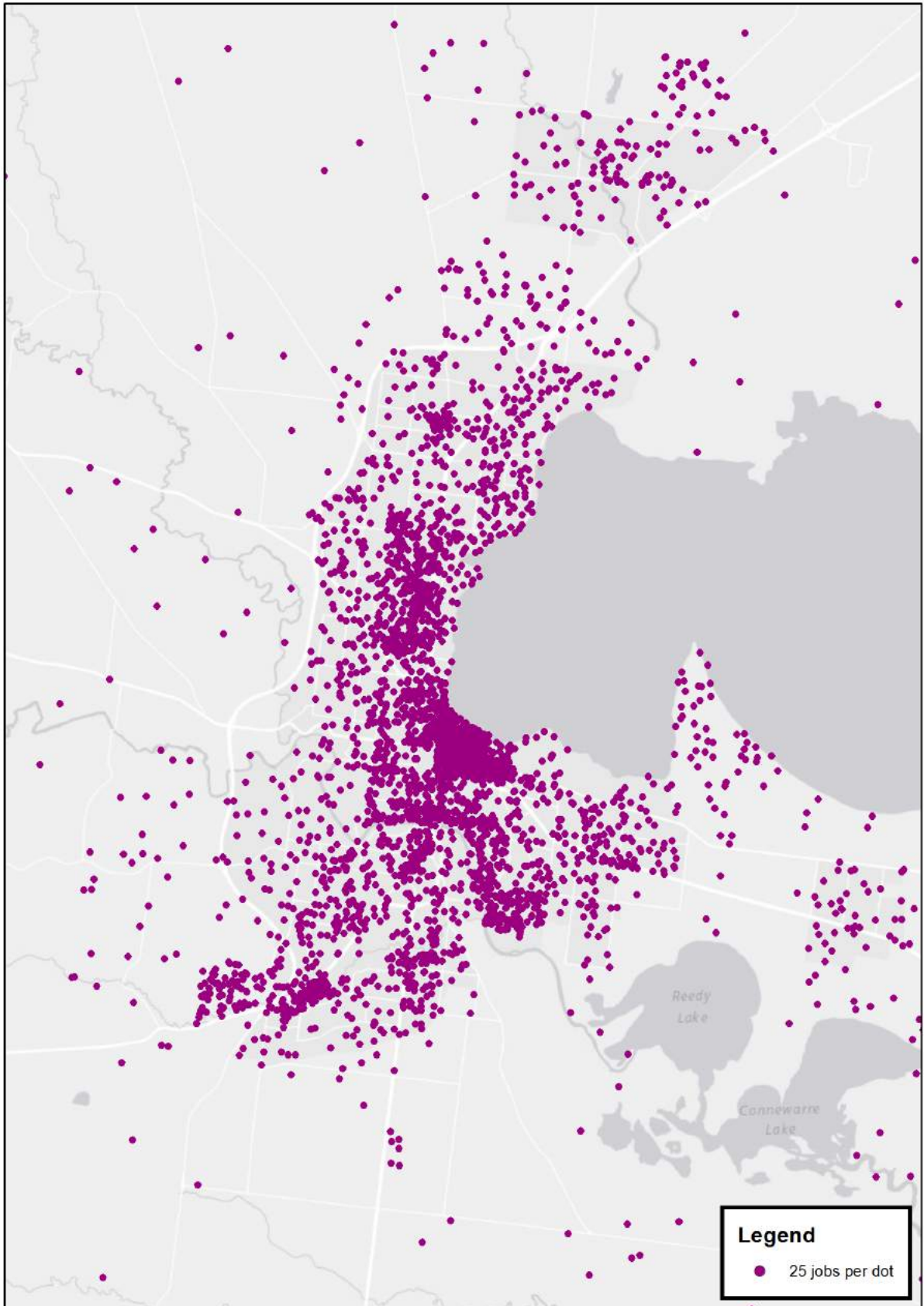


Figure 16 2021 Employment density

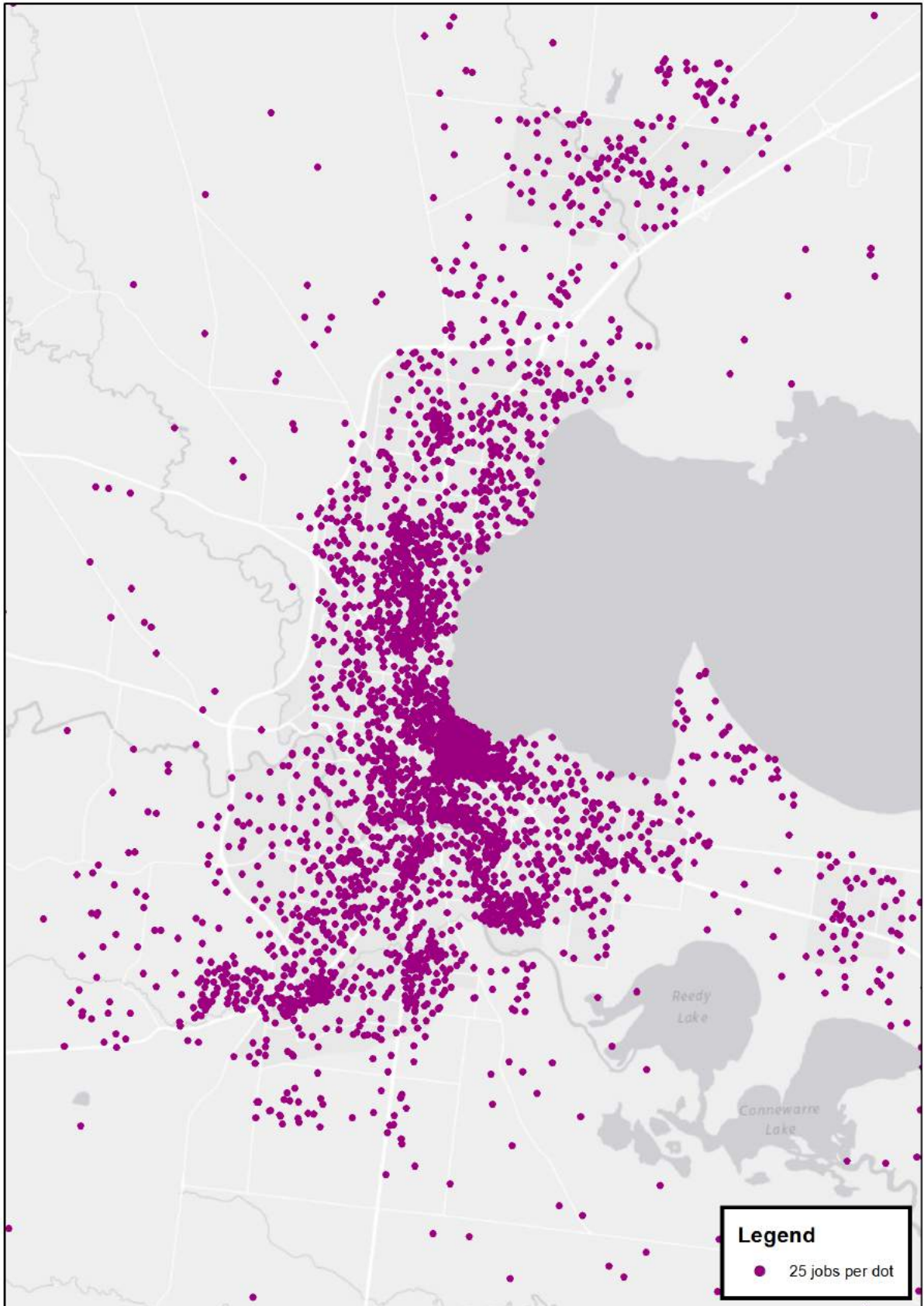


Figure 17 2031 Employment density

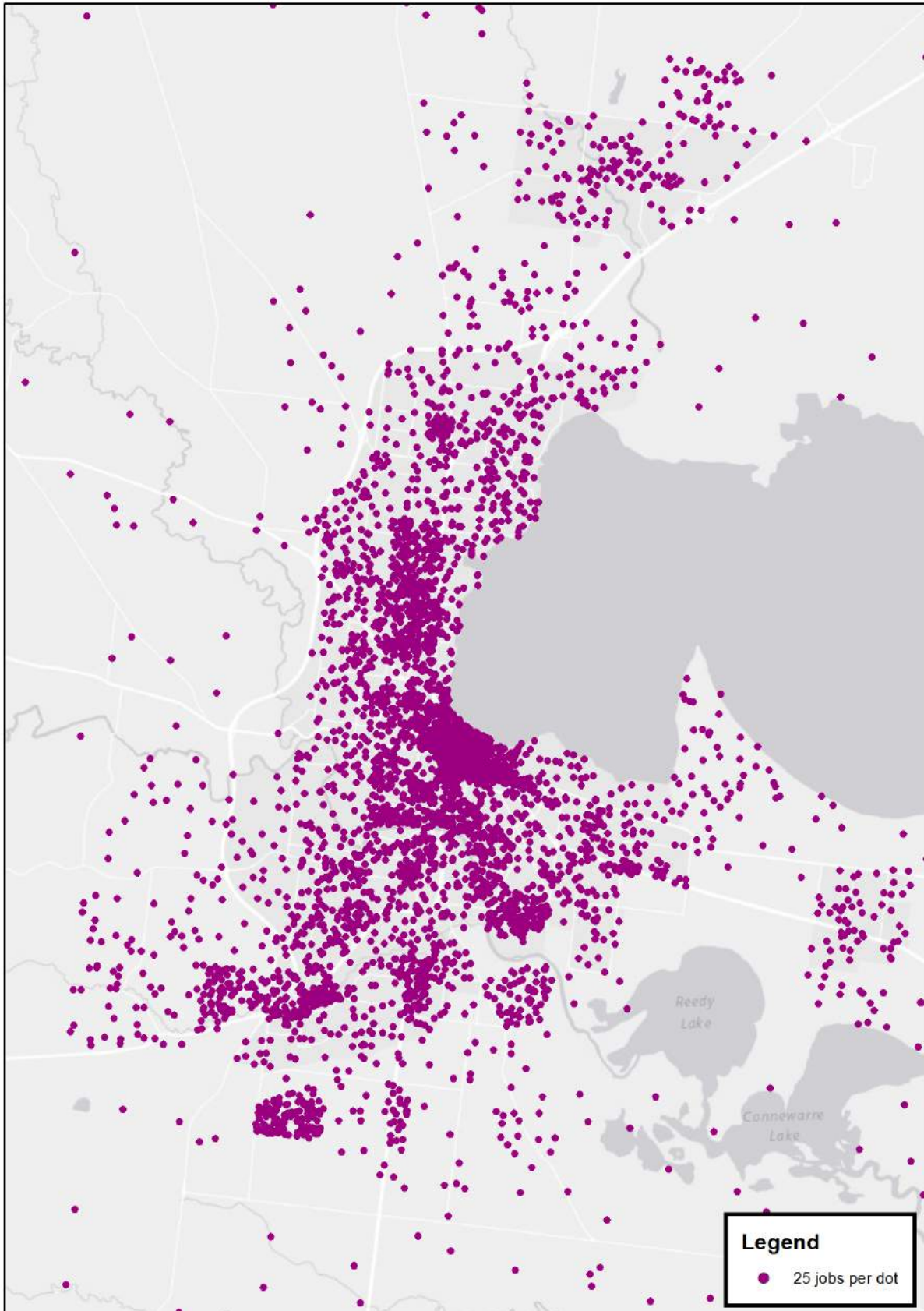
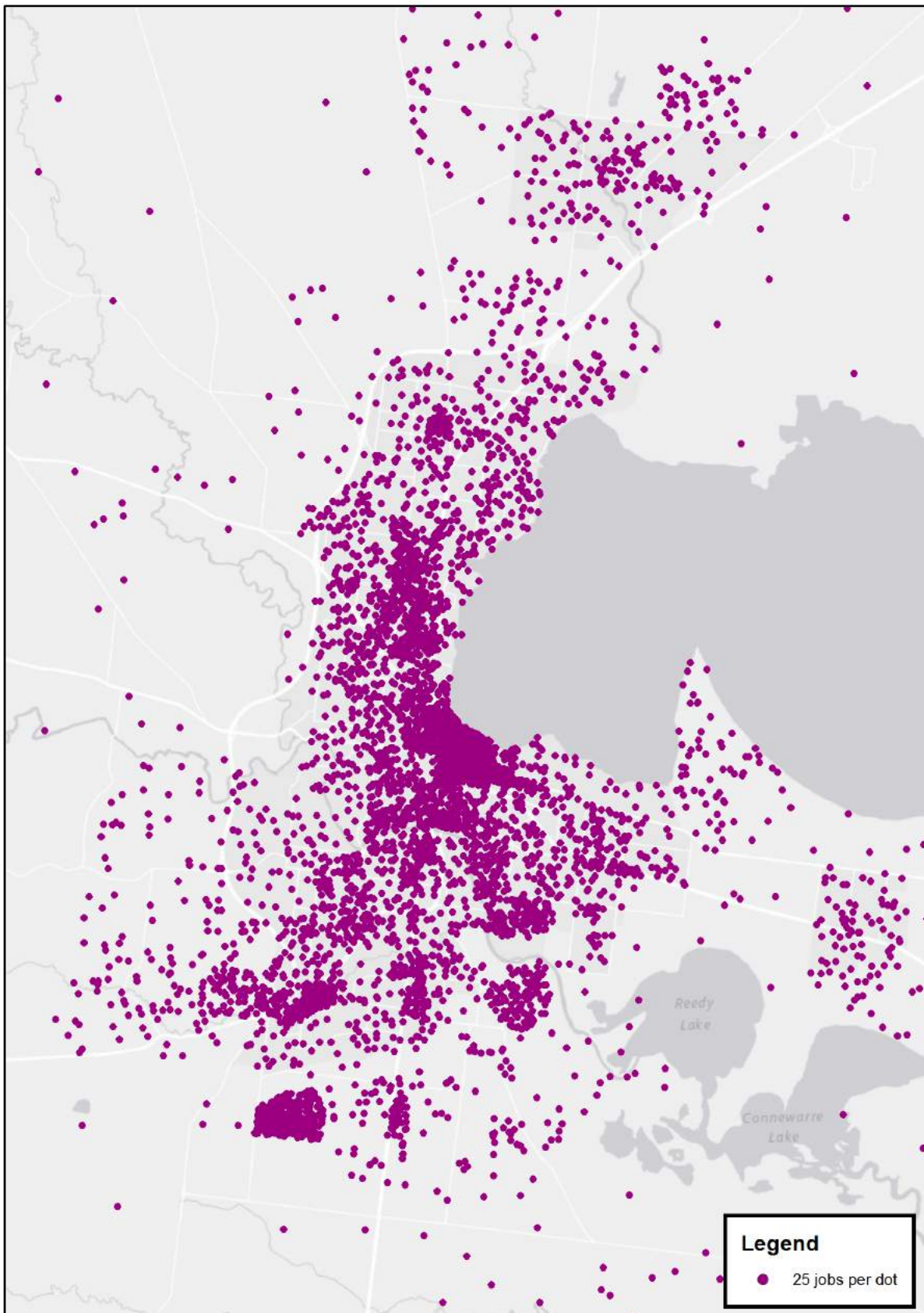


Figure 18 2041 Employment density



4.2.2 City of Greater Geelong council land use

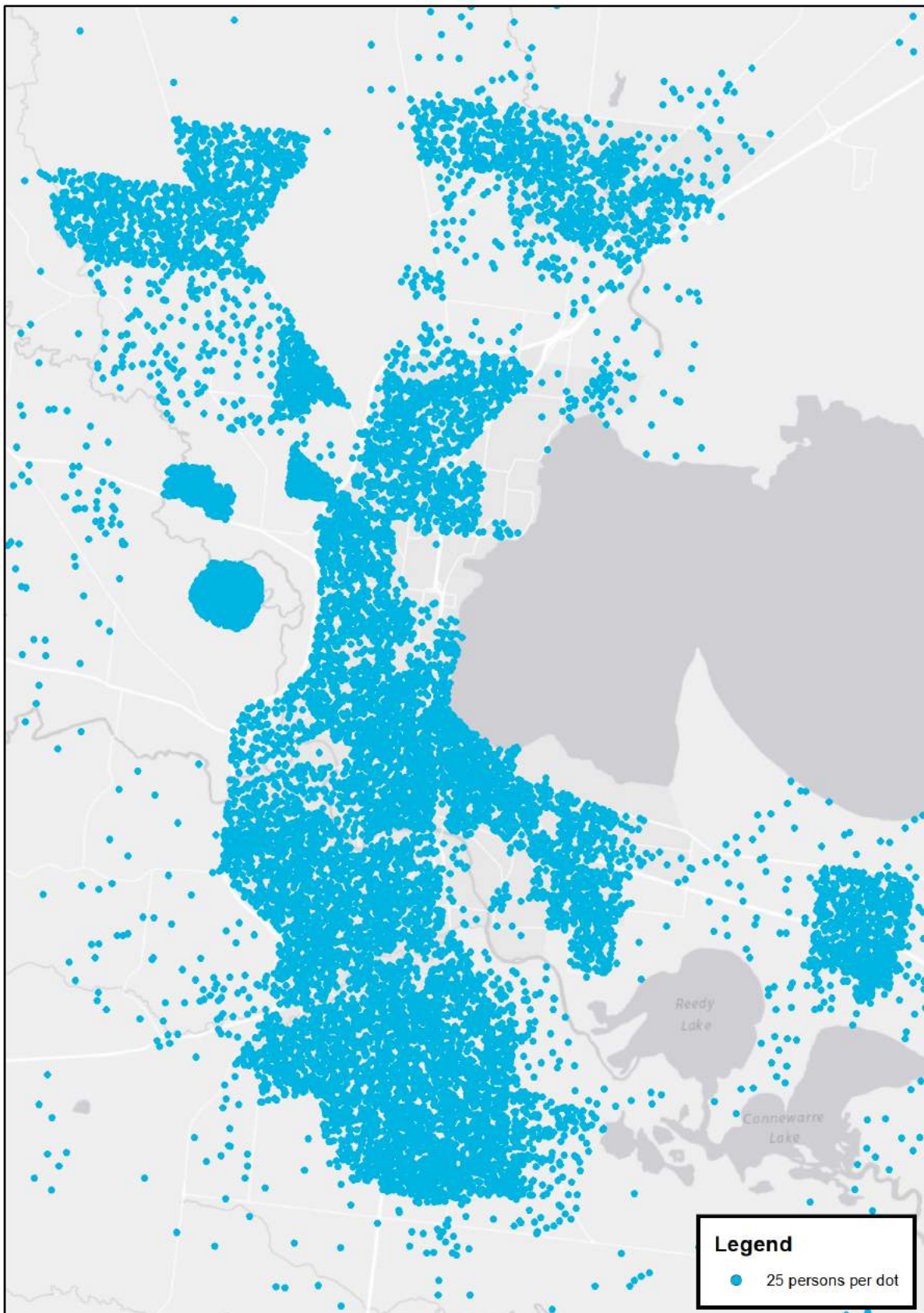
City of Greater Geelong Council (CoGGC) has developed a set of alternative land use development plans for Geelong. These land use plans reflect the North West Geelong Growth Areas (NWGGA). A comparison between this land use and the Reference Case (by TfV) is shown in Table 39. The additional growth in 2041 is predicted to occur mainly in Corio – Norlane, North Geelong - Bell Park and Geelong West - Hamlyn Heights. Figure 19 shows the forecast population density due to the planned Council land use. The CoGGC land use indicates that the Geelong population is expected to grow from 283,000 people in 2016 to 518,900 people in 2041, representing an annual population growth rate of 2.5%, which is higher than the Reference Case growth rate of 1.95%.

Due to the alternative land use, the number of zones in the model would increase (consequently requiring additional model coding), it was therefore agreed with TfV for the purpose of this study to aggregate the additional demographic data into the pre-existing zones. In addition to this a network review was conducted and future major proposed roads in the growth areas were included into the scenario networks. This would allow the model to more accurately distribute traffic without being forced by the connection of centroid connectors.

Table 39 Comparison of 2041 land use between Council and Reference Case (TfV)

SA2 within Geelong SA4	Population		Employment		Enrolments	
	Geelong Council	Reference Case	Geelong Council	Reference Case	Geelong Council	Reference Case
Bannockburn	14,000	13,900	2,200	2,800	1,200	1,500
Golden Plains - South	9,800	9,800	2,500	2,700	800	1,000
Leopold	19,000	19,000	2,100	2,500	1,500	1,700
Newcomb - Moolap	14,900	16,600	6,600	7,100	800	1,000
Lara	31,900	31,500	12,200	8,200	2,800	3,500
Corio - Norlane	63,200	38,200	10,000	10,400	5,800	5,300
North Geelong - Bell Park	35,800	20,700	14,400	14,800	6,200	5,600
Geelong West - Hamlyn Heights	50,500	28,800	10,700	8,800	5,400	4,900
Geelong	21,200	16,800	44,800	49,700	31,600	34,100
Portarlington	9,700	10,000	1,500	1,800	200	200
Clifton Springs	24,800	22,200	4,300	5,100	5,300	5,100
Point Lonsdale – Queenscliff	4,100	4,100	3,100	3,700	300	400
Ocean Grove - Barwon Heads	48,000	49,200	8,200	9,800	3,900	4,400
Newtown (Vic.)	13,800	13,100	6,200	6,600	11,700	12,300
Highton	30,200	29,700	9,300	10,500	27,400	30,800
Belmont	15,500	16,400	8,100	8,400	5,100	4,800
Grovedale	66,000	61,200	16,400	21,900	6,900	8,000
Torquay	35,000	35,000	8,600	10,200	3,800	4,700
Winchelsea	6,500	6,500	3,100	3,600	500	500
Lorne - Anglesea	5,000	5,000	3,700	4,200	300	400
Total	518,900	447,700	178,000	192,800	121,500	130,200

Figure 19 2041 Council land use - Population density



4.3 Future year road network

The future year road networks in the reference models were provided by TfV. They were checked against the existing road network. Errors identified in the existing road network during the model validation were corrected and incorporated in the future road networks.

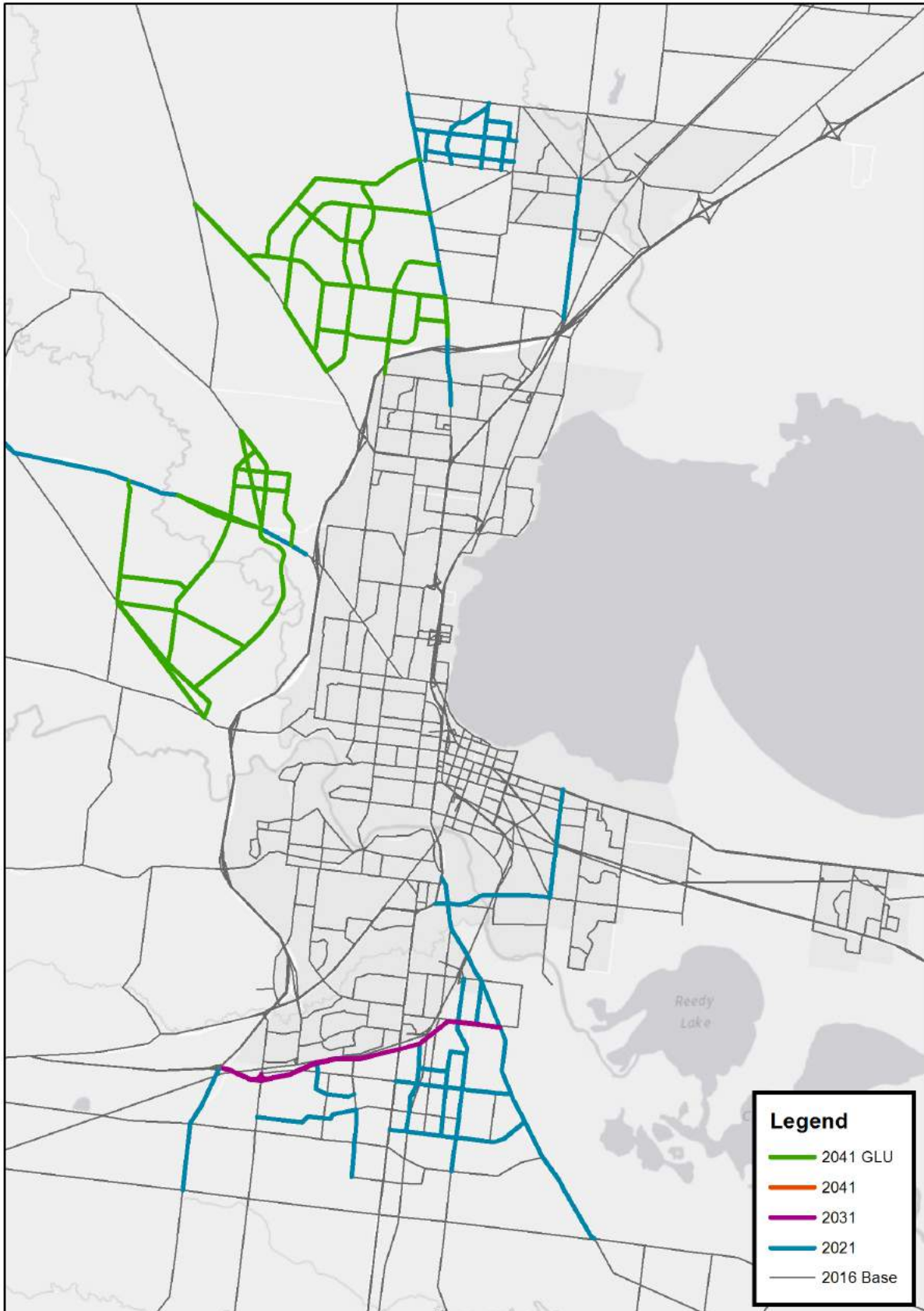
The proposed road improvements in growth areas identified by the Geelong Growth Area Study were also included in the future road networks. A summary of the proposed upgrades to the existing network and the expected period in the future the upgrade is likely to be implemented is shown in Table 40.

Table 40 Future road network upgrades

Project	Scope
Year 2016	
Centennial Blvd - P1=21018 to Sealark Way	New Road (2 Lanes)
Centennial Blvd / Sealar Way - Oceania Dr to Jetty Rd	New Road (2 Lanes divided)
Ocenia Dr - Peace Rd to Pieview Dr	New Road (2 Lanes)
Bellarine Link (Baanip Bvd) - Anglesea Rd to Surf Coast Hwy (Torquay Rd)	New route (2 lanes)
Geelong Ring Road Extension / Princes Freeway - Anglesea Rd to Waurn Ponds Dr	New route (4 lane freeway)
Malop Street - Gheringhap St to Garden St	Downgrading to bus link only
Malop Street - Gheringhap St to Garden St	Closure
Year 2021	
Coastside Dr - Surfcoast Hwy to Stewarts Rd	New Road (2 lanes)
Sovereign Dr - Unity Drive to Baanip Boulevard	New Road (2 lanes)
Stewarts Rd - Surfcoast Hwy to Horseshoe Bend Rd	New Road (2 lanes)
Unity Drive - Sovereign Dr to Surfcoast Rd	New Road (2 lanes)
Warrally Blvd - Horseshoe Bend Rd to Barwon Heads Rd	New Road (2 lanes)
Year 2031 and beyond	
Anglesea Road - Geelong Ring Road to Mount Duneed Rd	Duplication (4 lane divided)
Bacchus Marsh Road - Elcho Rd to Geelong Ring Rd	Duplication (4 lane divided)
Bacchus Marsh Road - Elcho Rd to Windermere Rd	Duplication (4 lane divided)
Bacchus Marsh Road - Geelong Ring Rd to Teleta Cr	Duplication (4 lane divided)
Barwon Heads Road - La Trobe Tce to Lower Duneed Rd	Duplication (4 lane divided)
Belchers Rd - Gubb Rd to Peninsula Dr (extention)	New Road (2 lanes)
Bellarine Link - Baanip Bvd to Barwon Heads Rd	New route (2 lanes)
Bellarine Link - Baanip Bvd to Barwon Heads Rd	Duplication (4 lane divided)
Bellarine Link (Baanip Bvd) - Anglesea Rd to Torquay Rd	Duplication (4 lane divided)
Boundary Rd - Surfcoast Hwy to Barwon Heads Rd	Widening (4 Lanes)
Breakwater Road - Barwon River to St Albans Rd	Duplication (4 lane divided)
Breakwater Road - St Albans Rd to Portarlinton Rd	Duplication (4 lane divided)
Burvilles Rd - Horseshoe Bend Rd to Barwon Heads Rd	New Road (4 Lanes connector)
Burvilles Rd - Torquay Rd to Horseshoe Bend Rd	New Road (4 Lanes connector)
Drews Rd - Reserve Rd to Tannery Rd	New Road (2 lanes)

Project	Scope
East-West Connector - Bacchus Marsh Rd to Ohallorans Rd	New Road (2 Lanes divided)
East-West Connector - between P2=22224 to P2=22225	New Road (4 Lanes connector)
East-West Connector - Ghazeeopore Rd to Unity Dr	New Road (2 lanes)
East-West Connector -P1=21036 to Ohallorans Rd	New Road (2 Lanes)
Forest Road South - Station Lake Rd to Geelong Ring Rd	Duplication (4 lane divided)
Horseshoe Bend Rd - Boundary Rd to Burvilles Rd	Duplication (4 lanes divided)
Horseshoe Bend Rd - Burvilles Rd to Stewarts Rd	Duplication (4 lanes divided)
Horseshoe Bend Rd - Reserve Rd to Barwon Heads Rd	Duplication (4 lanes divided)
Horseshoe Bend Rd - Reserve Rd to Boundary Rd	Duplication (4 lanes divided)
Midland Highway - Shelford Bannockburn Rd to Geelong Ring Rd	Duplication (4 lane divided)
North_South Connector - Sovereign Rd to Freehans Rd	New Road (2 lanes)
North-south Connector - Burvilles Rd to Baanip Boulevard	New Road (4 Lanes connector)
North-south Connector - Burvilles Rd to Boundary Rd	New Road (4 Lanes connector)
North-south Connector - Burvilles Rd to Boundary Rd	New Road (4 Lanes connector)
North-south Connector - Burvilles Rd to Horseshoe Bend Rd	New Road (4 Lanes connector)
North-South Connector - Centennial Blvd to South	New Road (2 Lanes)
North-South Connector - Ocenia Dr to Centennial Blvd	New Road (2 Lanes)
North-South Connector - Ocenia Dr to North	New Road (2 Lanes)
North-South Connector - P1=21030 to Patullos Rd	New Road (2 Lanes)
North-South Connector - P1=21034 to Patullos Rd	New Road (2 Lanes)
North-South Connector - P1=21034 to P1=21030	New Road (2 Lanes)
North-South Connector - Patullos Rd to P1=21030	New Road (2 Lanes)
North-South Connector - Portarlinton Rd to Coriyule Rd	New Road (2 lanes)
North-South Connector - Sovereign Dr to Baanip Boulevard	New Road (2 lanes)
North-South Connector - Windermere Rd to Patullos Rd	New Road (2 Lanes)
Peninsular Dr Extension - Penincular Dr to Belcher Rd	New Road (2 lanes)

Figure 20 Changes to the existing road network in the future years



4.4 Public transport services

4.4.1 Rail Services

Information provided by TfV shows how rail services to, from or through Geelong are expected to change in the future. Table 41 outlines the stopping pattern for the base and future years.

Table 41 Stopping patterns for base and future year rail services

Origin-Destination	2016 (Base)	2021	2031	2041
Deer park - Warrnambool	Express to Tarneit, all stations to Wyndham Vale, express to Lara then to North Shore - all stations to Warrnambool	Same as Base	-	-
Footscray - Warrnambool	-	-	Express to Geelong then Waurn Ponds - all stations to Warrnambool	Same as 2031
Footscray - Waurn Ponds	-	-	Six different stopping patterns from Sunshine to Northshore	Same as 2031
Marshall - Southern Cross	All stations except for Sunshine	Same as Base	Six different stopping patterns from Northshore to Sunshine	Same as 2031
Geelong - Southern Cross	All stations except for Sunshine	Same as Base	-	-
North Geelong - Southern Cross	All stations except for Black Forrest and Sunshine	Same as Base	-	-
Sherwood Park - Southern Cross	All stations to North Shore, express to Lara then to Wyndham Vale, all stations to Deer Park, express to Footscray	Same as Base	All stations to Waurn Ponds, express to Geelong then Footscray	Same as 2031
Sunshine - Waurn Ponds	All stations except for Black Forrest and Sunshine	Same as Base	-	-

Table 42 shows the headways and the corresponding number of services for each time period in the base year and future years. AM, IP, PM and OP refers to each full model time period (AM-peak 7:00 – 9:00am, Inter-peak 9:00am – 3:00pm, PM-peak 3:00pm – 6:00pm and the Off-peak 6:00pm – 7:00am respectively). Headway refers to the number of minutes between trains. The number of services in 2041 is the same as that in 2031.

Table 42 Headways for base and future year rail services

Average headway	AM			IP			PM			OP		
	2016	2021	2031	2016	2021	2031	2016	2021	2031	2016	2021	2031
Geelong - Southern Cross	17.1	17.1	12.0	60.0	60.0	54.0	30.0	30.0	27.0	308.6	308.6	113.7
Southern Cross - Geelong	20.0	20.0	17.1	60.0	60.0	56.8	20.8	20.8	20.8	240.0	240.0	113.7
Number of services												
Geelong - Southern Cross	7.0	7.0	10.0	6.0	6.0	6.7	6.0	6.0	6.7	2.3	2.3	6.3
Southern Cross - Geelong	6.0	6.0	7.0	6.0	6.0	6.3	8.7	8.7	8.7	3.0	3.0	6.3

4.4.2 Bus services

TfV has produced expected statewide bus service information for future years. In the Geelong model study area, this includes increases to existing service frequency as well as several additional services.

4.4.3 Parking capacity at railway station

When the model is run with parking capacity constrained for P&R at railway stations, the parking capacity would influence the P&R drivers on their choice of station. If the demand is over the capacity, the driver would consider switching over to another nearby stations or other access mode.

Table 43 outlines the parking capacity coded for each railway station in the study area, based on a 2015 PTV survey.

Table 43 P&R parking capacity (number of parking spaces) at railway station

Station	Off-Street	On-Street	Total
LARA	488	25	513
CORIO	81	0	81
NORTH SHORE	67	0	67
NORTH GEELONG	493	133	626
GEELONG	457	16	473
SOUTH GEELONG	570	521	1091
MARSHALL	446	54	500
WAURN PONDS	403	0	403
Total	3005	749	3754

4.5 Modelling scenarios

The main purpose of this study is to determine travel demand by access mode and parking demand at railway stations within the study area.

To estimate the base growth factors, the model runs for the 2016 base year and future years were set with unconstrained public transport capacity and P&R parking capacity so that they can forecast public transport demand and growth without constraint.

The VITM was also run with double constraints, i.e. public transport vehicle capacity constraints and P&R parking constraints at stations for all modelling years to provide a realistic set of growth factors.

As agreed with TfV, sensitivity tests were set up with double constraints for the 2041 future year. They included scenarios of high population growth provided by City of Greater Geelong Council and scenarios with reduced parking capacity at Geelong Station.

The modelling scenarios are shown in Table 44.

Table 44 Modelling scenarios

Scenario No.	Year	PT Unconstrained/Constrained	Land Use	Road Network	PT Services
1, 2	2016	Unconstrained/Constrained	TFV	2016 Reference	2016 Reference
3, 4	2021	Unconstrained/Constrained	TFV	2021 Reference	2021 Reference
5, 6	2031	Unconstrained/Constrained	TFV	2031 Reference	2031 Reference
7, 8	2041	Unconstrained/Constrained	TFV	2041 Reference	2041 Reference
9	2041	Constrained	Council	2041 Reference	2041 Reference
10	2041	Constrained	Council	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
11	2041	Constrained	TFV	2041 Reference	2041 Reference, Zero parking spaces at Geelong Station
12	2031	Constrained	TFV	2031 Reference	2031 Reference, Zero parking spaces at Geelong Station

The scenarios are further described below.

- PT unconstrained scenario represents a situation in which the capacity of train services and number of parking spaces at the station for P&R are unconstrained and would have no impact on PT travel demand
- PT constrained scenario represents a situation where if the train capacities or number of parking spaces at station are exceeded, passengers would face a penalty in terms of delay and would be encouraged to switch to other transport modes or other stations
- The reference road network would include the road network updates as per the 2012 GGATM model, provided by TfV
- Scenarios 1, 3, 5 & 7 (Base) were used to calculate unconstrained growth of patronage at the railway stations within the study area. Scenarios 2, 4, 6 & 8 (Sensitivity) were used to calculate constrained growth of patronage at these stations, and provide a check on the unconstrained growth rates
- Scenario 9 used the land use data provided by City of Greater Geelong Council. It was compared against Scenario 8 to indicate the impact of high population growth on the Station patronage. To facilitate the model run, the Council land use data was aggregated to be the same VITM (reference model) zone system
- Scenario 10 assumed that the off-street parking capacity at Geelong station was downgraded to near zero, and the parking capacity at other stations (such as Lara, North Geelong, and Marshall) would remain unchanged. The purpose is to investigate the distribution of P&R demand to other stations or other access transport modes when the parking at Geelong Station is removed
- Scenario 11 is similar to Scenario 10 except that the TfV land use data was used
- Scenario 12 is similar to Scenario 11 but run for year 2031 to estimate the impact of parking removed at Geelong Station for an intermediate year.

4.6 Analysis methodology

After the model runs for the base and future years were completed, a pivot approach was used to estimate the forecast of passenger entries and parking demand at the study stations. The methodology is described as below:

- Extract the passenger entries at each station within the study area for the base year 2016, and future years, 2021, 2031 and 2041
- Calculate annual growth factor for each station and apply the growth factors to the observed station entries using a pivot approach (see Appendix A).
- Split estimated daily passenger entries by time period using observed data
- Split passenger entries by time period into three main access modes, walking, bus transfer and park and drive (P&R) using model results
- Split bus transfer passengers into two sub-modes, cycling and bus. Similarly, P&R passengers were split into P&R driver, P&R passenger and Kiss and Ride (K&R) by using surveyed data from the individual stations.
- Determine the P&R parking demand at each study station by summing the P&R drivers over time periods.

4.6.1 Observed passenger entries

Table 45 below shows the observed passenger entries (departures only) by time period and by eight stations within the study area. The data were provided by Myki for an average day in April 2018, at the same period when the travel survey at the stations taken place. This data provides a base to provide forecast of future demand by the pivot approach.

Table 45 Observed passenger entries by station (source: Myki data)

Station	AM 7-8	IP 9-14	PM 15-17	OP 18-0 & 4-6	Daily
Lara	574	244	128	416	1362
Corio	14	24	30	22	90
North Shore	62	62	51	51	226
North Geelong	434	204	153	379	1170
Geelong	408	637	853	521	2419
South Geelong	641	392	253	714	2000
Marshall	266	103	45	283	697
Waurm Ponds	270	221	160	247	898
Total	2669	1887	1673	2633	8862

4.6.2 Observed station access mode share

Matrix Traffic and Transport Data Ltd conducted a face to face questionnaire survey at seven railway stations. Based on the survey data on mode choice, the following main access mode shares at each surveyed station were estimated and are outlined in Table 46.

In the AM peak period, 70% of passengers access all of the study stations travel by car, 17% by bus and 13% by walking.

In the PM peak, 45% accessed the study stations by car, 43% by bus and 12% by walking. The surveyed AM period is from 6:00 AM to 9:30 AM, while the surveyed PM period is from 15:00 PM to 19:00 PM.

Table 46 Observed station main access mode share

Station	Mode Share AM (6:00am to 9:30am)			Mode Share PM (15:00pm to 19:00pm)		
	Walk	Bus	Car	Walk	Bus	Car
Lara	9%	18%	74%	27%	13%	60%
North Shore	46%	11%	43%	21%	46%	33%
North Geelong	12%	10%	78%	19%	50%	32%
Geelong	10%	40%	50%	11%	57%	32%
South Geelong	12%	8%	80%	2%	42%	56%
Marshall	19%	8%	72%	13%	22%	66%
Waurnd Ponds	9%	14%	77%	0%	41%	59%
Total	13%	17%	70%	12%	43%	45%

The car access mode was further split into P&R driver (P&R_D), Kiss and Ride (K&R) and P&R passenger (P&R_P). The split was necessary to determine the P&R_D in future, which represents the parking demand. Similarly, the bicycle and bus access modes were split into constituent cycling and bus modes. Table 47 and Table 48 show the sub access mode share for the AM and PM periods respectively. The P&R driver share would represent the parking demand at the station.

Table 47 Observed station sub access mode share – AM period

AM	Drive Access mode				Cycle and Bus		
	P&R_D	K&R	P&R_P	Total	Cycle	Bus	Total
Lara	76%	24%	0%	100%	36%	64%	100%
North Shore	81%	19%	0%	100%	25%	75%	100%
North Geelong	79%	20%	1%	100%	28%	72%	100%
Geelong	71%	26%	3%	100%	3%	97%	100%
South Geelong	60%	30%	9%	100%	46%	54%	100%
Marshall	76%	24%	0%	100%	17%	83%	100%
Waurnd Ponds	56%	43%	1%	100%	31%	69%	100%
Total	69%	28%	3%	100%	18%	82%	100%

Table 48 Observed station sub access mode share – PM period

	Drive Access mode				Cycle and Bus		
	P&R_D	K&R	PnR_P	Total	Cycle	Bus	Total
Lara	68%	18%	14%	100%	38%	63%	100%
North Shore	88%	13%	0%	100%	27%	73%	100%
North Geelong	70%	30%	0%	100%	7%	93%	100%
Geelong	74%	22%	4%	100%	1%	99%	100%
South Geelong	46%	39%	15%	100%	3%	97%	100%
Marshall	62%	38%	0%	100%	14%	86%	100%
Waurnd Ponds	8%	84%	8%	100%	6%	94%	100%
Total	53%	41%	7%	100%	6%	94%	100%

4.7 Modelling results

While the main purpose of this study is to determine the parking demand at the study stations, the model also provides results in terms of highway traffic volumes and volume to capacity ratios as well as the overall network performance such as vehicle travel hours and vehicle travel km for the whole city of Greater Geelong. The highway results are presented in appendices as below:

- Appendix C presents figures of highway traffic volumes, differences in traffic volumes and traffic volume to capacity ratios for constrained scenarios
- Appendix D presents the overall highway network performance in terms of vehicle travel hours, vehicle travel km and average speed for constrained scenarios

The following sections will focus on presenting the modelling results in terms of travel demand by access mode and parking demand at study stations for the base and future years.

4.7.1 Station entries by access mode for the base year

Using the Myki data (see Table 45) and observed mode shares shown in Table 46, Table 47, and Table 48, the 2018 observed daily demand by access mode was estimated and shown in Table 49.

The detailed passenger entries by access mode and for the four time periods are presented in Appendix B. To estimate the observed entries by access mode and by time period, two assumptions were made since survey data was not available for IP and OP time periods and Corio station was not part of the study survey scope:

- The observed access mode shares for IP and OP periods were estimated as the average of AM & PM mode shares
- The observed mode shares for Corio station was assumed to be the same as those for Lara station

Table 49 Estimated observed daily demand by access mode in 2018

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	678	207	32	30	181	240	1,368	535
Corio	42	12	4	1	11	19	90	25
North Shore	70	14	0	7	62	72	226	49
North Geelong	489	136	6	39	323	182	1,175	408
Geelong	655	220	30	125	1,127	262	2,419	393
South Geelong	762	434	142	57	479	132	2,006	583
Marshall	350	130	0	13	94	111	698	265
Waurm Ponds	357	224	21	28	232	35	897	261
Total	3404	1,377	234	300	2,510	1,053	8,878	2,517

The daily parking demand at a station was estimated as the sum of P&R drivers arriving during the AM peak period, IP period and half of P&R drivers during the OP. The reason is that drivers arriving during the AM and IP were mostly for commuting or other trip purposes which would require all day or long duration parking.

Parking demand during the PM period is mainly comprised of short duration parkers, by which time parkers during the AM period would be starting to depart. Driver demand during OP can be divided into two periods, pre-midnight and after-midnight. The pre-midnight trips are similar to PM, while the after-midnight (5.00 - 7.00 AM) would be early commuters. In summary, the daily parking demand is estimated as:

$$\text{Daily parking demand} = P\&R_D \text{ in AM} + P\&R_D \text{ in IP} + \frac{1}{2} P\&R_D \text{ in OP}$$

Table 50 shows a comparison between the observed parking demand (including on and off-street parking) estimated using Myki data, observed mode share, and the above formula, and parking demand (off-street only) obtained from the parking occupancy survey analysis. The comparison demonstrates the total estimated parking demand is very close to the surveyed parking demand although the survey parking demand including off-street only. Therefore, it is confirmed that the method to estimate daily parking demand is acceptable.

Table 50 Comparison between estimated observed daily parking demand and surveyed off-street parking demand & supply in 2018

Station	Estimated observed Parking Demand (1)	Surveyed Off-Street Parking Demand (2)	%Diff (1-2)/2
Lara	535	552	-3%
Corio	25	NA	NA
North Shore	49	21	132%
North Geelong	408	440	-7%
Geelong	393	426	-8%
South Geelong	583	532	9%
Marshall	265	341	-22%
Waurm Ponds	261	212	23%
Total	2,517	2,524	0%

4.7.2 Station entries by access mode for future years (unconstrained model)

As discussed in Section 4.6, the forecast of station entries was based on the pivot approach using the 2018 Myki data as the base. Table 51 shows the 2018 observed daily station entries, modelled daily entries together with the daily entries resulted from the pivot approach.

Table 51 Forecast of daily station entries by pivot approach (unconstrained model)

Station	Observed 2018	Modelled Daily Entries					Pivoted Daily Entries		
		2016	2018	2021	2031	2041	2021	2031	2041
Lara	1,362	379	398	427	693	882	1,460	2,370	2,773
Corio	90	392	411	439	439	601	96	96	132
North Shore	226	563	586	620	466	633	239	180	244
North Geelong	1,170	679	726	796	1,102	1,386	1,283	1,776	2,233
Geelong	2,419	2,475	2,629	2,860	4,293	5,440	2,632	3,950	5,005
South Geelong	2,000	3,352	3,584	3,933	5,205	5,763	2,195	2,905	3,216
Marshall	697	337	371	421	1,479	2,656	792	2,510	3,687
Waurm Ponds	898	391	420	463	1,041	1,469	990	2,226	2,825
Total	8,862	8,569	9,125	9,959	14,718	18,829	9,685	16,012	20,116

The pivoted daily entries were then split into time period entries using the Myki data, and consequently further split by main mode share using the model results. The modelled mode share was used because it would consider the future PT services, highway network conditions and surrounding land use in the forecast of mode share. However, the splitting of main access mode into sub-modes like P&R_D, P&R_P and K&R was based on the surveyed data because the sub-modes are not represented by the model.

Table 52, Table 53 and Table 54 show the results of daily passenger entries by access mode by the unconstrained model for the future years 2021, 2031 and 2041 respectively. The detailed results by time period are shown in Appendix B.

Table 52 2021 Daily passenger entries by access mode (pivoted and unconstrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	667	206	23	1	9	554	1,460	558
Corio	25	8	1	1	10	51	96	20
North Shore	90	20	0	2	23	105	239	85
North Geelong	413	110	5	7	62	686	1,283	384
Geelong	651	228	28	86	786	853	2,632	494
South Geelong	624	331	106	62	556	515	2,195	579
Marshall	246	87	0	19	161	279	792	213
Waurm Ponds	170	111	7	22	228	452	990	152
Total	2,885	1100	170	201	1,836	3,494	9,685	2,486

Table 53 2031 Daily passenger entries by access mode (pivoted and unconstrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,229	379	43	2	16	700	2,370	1,031
Corio	21	6	1	2	15	52	96	17
North Shore	58	13	0	2	18	89	180	54
North Geelong	578	151	7	10	91	940	1,776	554
Geelong	890	310	38	149	1,320	1,242	3,950	657
South Geelong	908	486	155	75	678	602	2,905	808
Marshall	1,061	373	0	52	436	589	2,510	914
Waurm Ponds	569	361	24	41	426	804	2,226	495
Total	5,314	2,079	268	333	3,000	5,019	16,013	4,530

Table 54 2041 Daily passenger entries by access mode (pivoted and unconstrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,497	461	53	4	29	728	2,773	1,255
Corio	30	9	1	2	21	68	132	24
North Shore	80	17	0	3	27	118	244	73
North Geelong	741	194	9	13	117	1159	2,233	706
Geelong	1,086	378	47	191	1,678	1,625	5,005	798
South Geelong	984	527	168	88	772	677	3,216	871
Marshall	1,603	560	0	76	642	807	3,687	1,388
Waurm Ponds	741	475	30	46	481	1,052	2,826	654
Total	6,762	2,622	309	422	3,766	6,235	20,116	5,768

The tables show that the total passenger entries are forecast to grow steadily from 9,700 in 2021 to 16,000 in 2031 and 20,100 in 2041. Correspondingly, parking demand is predicted to grow to 2,500 cars in 2021 to 4,500 in 2031 and 5,800 in 2041.

4.7.3 Station entries by access mode for future years (constrained model)

Similarly using the constrained model, the following 8 scenarios have been tested.

- 2016, 2021, 2031 and 2041 scenarios using referenced land use (TFV)
- 2041 scenario using Geelong Council land use (GLU)
- 2031 scenario using TFV land use and no parking at Geelong station
- 2041 scenario using TFV land use and no parking at Geelong station
- 2041 scenario using GLU and no parking at Geelong station

Table 55 shows the modelled daily entries for 8 scenarios using constrained model runs. Table 56 shows the forecast of daily entries by using the pivot approach with the 2018 observed entries as the pivot base.

Table 55 Modelled daily entries for base and scenarios (constrained model)

Station	Base				2041 GLU	No parking at Geelong		
	2016	2021	2031	2041		2031	2041	2041 GLU
Lara	443	506	741	963	1,579	756	997	1,653
Corio	447	473	473	571	529	480	578	551
North Shore	352	382	370	452	455	388	469	470
North Geelong	936	1,119	1,401	1,710	2,143	1,675	2,066	2,605
Geelong	2,745	3,161	4,437	5,394	6,166	4,019	4,929	5,438
South Geelong	3,020	3,471	4,423	5,487	5,868	4,263	4,996	5,362
Marshall	364	460	1,575	2,049	2,162	1,789	2,322	2,381
Waurm Ponds	426	509	1,296	1,466	1,645	1,345	1,587	1,715
Total	8,734	10,080	14,717	18,093	20,548	14,715	17,944	20,176

Table 56 Forecast of daily station entries by pivot approach (constrained model)

Station	Observed 2018	Base			2041 GLU	No parking at Geelong		
		2021	2031	2041		2031	2041	2041 GLU
Lara	1,362	1,471	2,155	2,800	3,563	2,198	2,897	3,637
Corio	90	93	93	112	104	94	114	108
North Shore	226	237	229	281	283	241	291	292
North Geelong	1,170	1,298	1,625	1,983	2,485	1,942	2,395	3,020
Geelong	2,419	2,626	3,686	4,482	5,123	3,339	4,096	4,518
South Geelong	2,000	2,169	2,764	3,429	3,667	2,664	3,122	3,351
Marshall	697	796	2,573	3,047	3,160	2,787	3,320	3,379
Waurm Ponds	898	996	2,536	2,808	2,987	2,632	2,929	3,057
Total	8,862	9,686	15,661	18,941	21,371	15,898	19,164	21,362

Similarly, to the unconstrained scenarios, the pivoted daily entries were split by time period using the Myki data, then by main mode share using the model results, and finally by sub-access modes using surveyed data.

Table 57 to Table 63 show the results of daily passenger entries by sub-access mode for eight scenarios respectively. The detailed results by time period are shown in Appendix B.

Table 57 2021 Daily passenger entries by access mode (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	720	222	25	2	13	490	1,471	606
Corio	25	8	1	1	10	48	93	20
North Shore	76	16	-	3	27	115	237	67
North Geelong	472	126	6	6	58	630	1,298	458
Geelong	685	240	29	78	752	843	2,626	527
South Geelong	524	274	89	71	616	595	2,169	518
Marshall	405	147	-	9	78	158	796	309
Waurm Ponds	208	134	9	22	222	401	996	188
Total	3,114	1,167	159	190	1,776	3,281	9,686	2,693

Table 58 2031 Daily passenger entries by access mode (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,150	355	40	3	22	585	2,155	967
Corio	22	7	1	2	13	48	93	18
North Shore	72	16	-	3	26	114	229	61
North Geelong	576	151	7	8	76	807	1,625	574
Geelong	901	315	39	126	1,167	1,139	3,686	680
South Geelong	653	341	110	95	814	751	2,764	653
Marshall	1,496	536	-	25	220	296	2,573	1,169
Waurm Ponds	786	494	33	43	459	720	2,536	700
Total	5,656	2,214	231	303	2,798	4,459	15,661	4,823

Table 59 2041 Daily passenger entries by access mode (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,563	482	56	5	37	658	2,800	1,313
Corio	27	8	1	2	18	56	112	21
North Shore	89	19	-	4	36	133	281	74
North Geelong	716	187	9	10	95	966	1,983	714
Geelong	1,042	364	45	161	1,465	1,404	4,482	777
South Geelong	831	436	141	116	998	907	3,429	831
Marshall	1,706	608	-	36	310	386	3,047	1,343
Waurm Ponds	769	500	30	47	486	976	2,808	682
Total	6,743	2,605	281	381	3,446	5,487	18,941	5,755

Table 57, Table 58 and Table 59 show that passenger demand is set to grow to 9,700 entries in 2021 to 15,700 in 2031 and 18,900 in 2041. The entries are in the same order as those of unconstrained scenarios although slightly lower. Overall the station entries represent a growth of 3.4 percent per annum between 2021 and 2041, even though the population would grow only at 1.7 percent per annum during the same time period. Similarly, the number of parking demand is forecast to grow to 2,700 cars in 2021 to 4,800 in 2031 and 5,800 in 2041.

Table 60 shows the station entries by access mode for the 2041 scenario with Council land use.

When comparing against the 2041 scenario with TfV land use, the total entries would increase by 12% while the parking demand would increase by 16%. At the station level, Council land use would result in an increase of entries at Lara, North Geelong and Geelong station by 25%, 22% and 14% respectively. Similar growth patterns can be seen in the predicted parking demands which would increase at the same stations by 34%, 25% and 25% respectively. This pattern would be due to the distribution of the additional population at the growth areas near the stations.

Table 60 2041 Daily passenger entries by access mode – CCL Land use (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	2,182	671	84	3	24	599	3,563	1,800
Corio	28	9	2	2	17	46	104	20
North Shore	84	18	-	6	62	112	283	74
North Geelong	964	256	12	12	115	1,126	2,485	940
Geelong	1,204	422	51	163	1,503	1,779	5,123	902
South Geelong	917	482	155	118	1,009	984	3,667	917
Marshall	1,725	612	-	36	313	472	3,160	1,349
Waurm Ponds	850	551	34	45	468	1,038	2,987	758
Total	7,955	3,022	338	387	3,513	6,157	21,371	6,760

Table 61 to Table 63 show the results of station entries and parking demand if the parking at Geelong Station was removed. The purpose of the test was to find out how the parking demand be diverted to other stations.

Table 61 2031 Daily passenger entries by access mode – No parking at Geelong Station (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,180	355	42	3	22	589	2,198	993
Corio	24	7	1	2	14	47	94	19
North Shore	84	16	-	3	29	108	241	71
North Geelong	1,008	151	12	3	27	637	1,942	853
Geelong	-	384	-	200	1,576	1,517	3,339	-
South Geelong	870	341	151	57	490	638	2,664	771
Marshall	1,721	536	-	21	192	242	2,787	1,326
Waurm Ponds	841	494	36	44	477	709	2,632	734
Total	5,727	2,283	242	333	2,827	4,486	15,898	4,768

Table 62 2041 Daily passenger entries by access mode – No parking at Geelong Station (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	1,630	482	58	5	38	667	2,897	1,370
Corio	28	8	1	2	18	55	114	22
North Shore	100	19	-	4	39	127	291	83
North Geelong	1,282	187	16	3	35	731	2,395	1,087
Geelong	-	486	-	253	1,969	1,824	4,096	0
South Geelong	1,019	436	178	67	578	738	3,122	895
Marshall	1,976	608	-	32	279	335	3,320	1,538
Waurm Ponds	928	500	39	44	468	872	2,929	814
Total	6,962	2,726	292	410	3,424	5,350	19,164	5,809

Table 63 2041 Daily passenger entries by access mode – CCL land use and no parking at Geelong Station (pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	2,239	671	86	3	23	598	3,637	1,848
Corio	32	9	2	2	17	47	108	23
North Shore	96	18	-	6	63	107	292	83
North Geelong	1,783	256	22	3	32	718	3,020	1,459
Geelong	-	523	-	260	1,999	2,207	4,518	0
South Geelong	1,085	482	189	65	557	875	3,351	963
Marshall	1,979	612	-	32	275	394	3,379	1,539
Waurm Ponds	982	551	41	42	445	933	3,057	853
Total	8,196	3,123	341	412	3,411	5,879	21,362	6,767

Table 64, Table 65 and Table 66 show percentage differences of daily passenger entries by access mode between the scenario of removing parking at Geelong Station in 2031, 2041 and 2041 (with the Council land use) and its corresponding base respectively.

Table 64 % difference of daily passenger entries by access mode between no parking at Geelong Station and base (2031, pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	3%	0%	5%	0%	0%	1%	2%	3%
Corio	9%	0%	0%	0%	8%	-2%	1%	6%
North Shore	17%	0%	0%	0%	12%	-5%	4%	16%
North Geelong	75%	0%	71%	-63%	-64%	-21%	13%	46%
Geelong	-100%	22%	-100%	59%	35%	33%	0%	-100%
South Geelong	33%	0%	42%	-40%	-40%	-15%	-8%	17%
Marshall	15%	0%	0%	-16%	-13%	-18%	5%	13%
Waurm Ponds	7%	0%	9%	2%	4%	-2%	3%	5%
Total	1%	3%	6%	10%	1%	1%	2%	-2%

Table 65 % difference of daily passenger entries by access mode between no parking at Geelong Station and base (2041, pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	4%	0%	4%	0%	3%	1%	3%	4%
Corio	4%	0%	0%	0%	0%	-2%	1%	5%
North Shore	12%	0%	0%	0%	8%	-5%	3%	12%
North Geelong	79%	0%	78%	-70%	-63%	-24%	14%	52%
Geelong	-100%	34%	-100%	57%	34%	30%	1%	-100%
South Geelong	23%	0%	29%	-42%	-42%	-19%	-12%	8%
Marshall	16%	0%	0%	-11%	-10%	-13%	6%	15%
Waurm Ponds	21%	0%	30%	-6%	-4%	-11%	2%	19%
Total	3%	5%	5%	8%	-1%	-2%	1%	1%

Table 66 % difference of daily passenger entries by access mode between no parking at Geelong Station and base (2041 GLU, pivoted and constrained model)

	P&R_D	K&R	P&R_P	Cycle	PT	Walk	Total Demand	Parking Demand
Lara	3%	0%	2%	0%	-4%	0%	2%	3%
Corio	14%	0%	0%	0%	0%	2%	3%	15%
North Shore	14%	0%	0%	0%	2%	-4%	2%	12%
North Geelong	85%	0%	83%	-75%	-72%	-36%	13%	55%
Geelong	-100%	24%	-100%	60%	33%	24%	-3%	-100%
South Geelong	18%	0%	25%	-45%	-45%	-11%	-11%	5%
Marshall	15%	0%	0%	-11%	-12%	-17%	4%	14%
Waurm Ponds	16%	0%	21%	-7%	-5%	-10%	0%	13%
Total	3%	3%	2%	6%	-3%	-5%	0%	0%

The percentages of difference between Table 64, Table 65 and Table 66 follow similar pattern. Looking at Table 66 (with GLU) as an example, when the parking at Geelong Station is removed, the passenger demand by P&R_D and P&R_P would be reduced by 100% as there is no parking, the other access modes to the station like K&R, Cycle, PT and Walk would increase by 24%, 60%, 33% and 24% respectively. Overall the passenger entries to Geelong station would decrease slightly by 3%. As anticipated, the P&R_D demand at adjacent stations like North Geelong, South Geelong would increase by 85% and 18% respectively. Similarly the P&R_D at further away stations like Corio, North Shore, Marshall and Waurn Ponds would increase by 14%-16%, and the farthest Lara Station would increase by 3%. Interestingly, the passenger demand by Cycle, PT and Walk to the adjacent stations like North Geelong and South Geelong would reduce by significant percentages 11-75%. This could be due to the reason that with the removal of P&R demand, the train loading at Geelong Station would be relieved as such that would attract demand from other access modes not only from the catchment of Geelong Station, but also from nearby stations.

4.7.4 Summary of daily entries by access modes and parking demand at each station

Table 67 to Table 72 provide a summary of daily entries for all scenarios by P&R_D, P&R_P, K&R, Cycle, PT and Walk respectively.

Table 67 Summary of station daily entries (pivoted) by P&R (driver only) under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurn Ponds	Total
2018									
Observed	678	42	70	489	655	762	350	357	3,404
2021									
Unconstrained	667	25	90	413	651	624	246	170	2,885
Constrained	720	25	76	472	685	524	405	208	3,114
2031									
Unconstrained	1,229	21	58	578	890	908	1,061	569	5,314
Constrained	1,150	22	72	576	901	653	1,496	786	5,656
Constrained – NGP	1,180	24	84	1,008	-	870	1,721	841	5,727
2041									
Unconstrained	1,497	30	80	741	1,086	984	1,603	741	6,762
Constrained	1,563	27	89	716	1,042	831	1,706	769	6,743
Constrained – NGP	1,630	28	100	1,282	-	1,019	1,976	928	6,962
Constrained - GLU	2,182	28	84	964	1,204	917	1,725	850	7,955
Cons. - GLU & NGP	2,239	32	96	1,783	-	1,085	1,979	982	8,196

Table 68 Summary of station daily entries (pivoted) by P&R (passenger only) under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurin Ponds	Total
2018									
Observed	32	4	-	6	30	142	-	21	234
2021									
Unconstrained	23	1	-	5	28	104	-	7	168
Constrained	25	1	-	6	29	89	-	9	159
2031									
Unconstrained	43	1	-	7	38	154	-	24	267
Constrained	40	1	-	7	39	110	-	33	231
Constrained – NGP	42	1	-	12	-	151	-	36	242
2041									
Unconstrained	53	1	-	9	47	167	-	30	308
Constrained	56	1	-	9	45	141	-	30	281
Constrained – NGP	58	1	-	16	-	178	-	39	292
Constrained - GLU	84	2	-	12	51	155	-	34	338
Cons. - GLU & NGP	86	2	-	22	-	189	-	41	341

Table 69 Summary of station daily entries (pivoted) by K&R under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurin Ponds	Total
2018									
Observed	207	12	14	136	220	434	130	224	1,377
2021									
Unconstrained	206	8	20	110	228	331	87	111	1,100
Constrained	222	8	16	126	240	274	147	134	1,167
2031									
Unconstrained	379	6	13	151	310	486	373	361	2,079
Constrained	355	7	16	151	315	341	536	494	2,214
Constrained – NGP	355	7	16	151	384	341	536	494	2,283
2041									
Unconstrained	461	9	17	194	378	527	560	475	2,622
Constrained	482	8	19	187	364	436	608	500	2,605
Constrained – NGP	482	8	19	187	486	436	608	500	2,726
Constrained - GLU	671	9	18	256	422	482	612	551	3,022
Cons. - GLU & NGP	671	9	18	256	523	482	612	551	3,123

Table 70 Summary of station daily entries (pivoted) by cycle under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds	Total
2018									
Observed	30	1	7	39	125	57	13	28	300
2021									
Unconstrained	1	1	2	7	86	62	19	22	201
Constrained	2	1	3	6	78	71	9	22	190
2031									
Unconstrained	2	2	2	10	149	75	52	41	333
Constrained	3	2	3	8	126	95	25	43	303
Constrained – NGP	3	2	3	3	200	57	21	44	333
2041									
Unconstrained	4	2	3	13	191	88	76	46	422
Constrained	5	2	4	10	161	116	36	47	381
Constrained – NGP	5	2	4	3	253	67	32	44	410
Constrained - GLU	3	2	6	12	163	118	36	45	387
Cons. - GLU & NGP	3	2	6	3	260	65	32	42	412

Table 71 Summary of station daily entries (pivoted) by PT under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds	Total
2018									
Observed	181	11	62	323	1,127	479	94	232	2,510
2021									
Unconstrained	9	10	23	62	786	556	161	228	1,836
Constrained	13	10	27	58	752	616	78	222	1,776
2031									
Unconstrained	16	15	18	91	1,320	678	436	426	3,000
Constrained	22	13	26	76	1,167	814	220	459	2,798
Constrained – NGP	22	14	29	27	1,576	490	192	477	2,827
2041									
Unconstrained	29	21	27	117	1,678	772	642	481	3,766
Constrained	37	18	36	95	1,465	998	310	486	3,446
Constrained – NGP	38	18	39	35	1,969	578	279	468	3,424
Constrained - GLU	24	17	62	115	1,503	1,009	313	468	3,513
Cons. - GLU & NGP	23	17	63	32	1,999	557	275	445	3,411

Table 72 Summary of station daily entries (pivoted) by walk under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurin Ponds	Total
2018									
Observed	240	19	72	182	262	132	111	35	1,053
2021									
Unconstrained	554	51	105	686	853	515	279	452	3,494
Constrained	490	48	115	630	843	595	158	401	3,281
2031									
Unconstrained	700	52	89	940	1,242	602	589	804	5,019
Constrained	585	48	114	807	1,139	751	296	720	4,459
Constrained – NGP	589	47	108	637	1,517	638	242	709	4,486
2041									
Unconstrained	728	68	118	1,159	1,625	677	807	1,052	6,235
Constrained	658	56	133	966	1,404	907	386	976	5,487
Constrained – NGP	667	55	127	731	1,824	738	335	872	5,350
Constrained - GLU	599	46	112	1,126	1,779	984	472	1,038	6,157
Cons. - GLU & NGP	598	47	107	718	2,207	875	394	933	5,879

Table 73 and Table 74 present a summary of station entries and parking demand under all scenarios for the base and horizon years. Looking at station entries at the same year, there are no significant differences between unconstrained and constrained scenarios although as expected the constrained entries are generally lower than the unconstrained ones. From here on, our analysis will focus on the constrained scenarios where other land use and parking scenarios were tested.

Table 73 Summary of station daily entries (pivoted) under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurin Ponds	Total
2018									
Observed	1,362	90	226	1,170	2,419	2,000	697	898	8,862
2021									
Unconstrained	1,460	96	239	1,283	2,632	2,195	792	990	9,685
Constrained	1,471	93	237	1,298	2,626	2,169	796	996	9,686
2031									
Unconstrained	2,370	96	180	1,776	3,950	2,905	2,510	2,226	16,012
Constrained	2,155	93	229	1,625	3,686	2,764	2,573	2,536	15,661
Constrained – NGP	2,198	94	241	1,942	3,339	2,664	2,787	2,632	15,898
2041									
Unconstrained	2,773	132	244	2,233	5,005	3,216	3,687	2,825	20,116
Constrained	2,800	112	281	1,983	4,482	3,429	3,047	2,808	18,941
Constrained – NGP	2,897	114	291	2,395	4,096	3,122	3,320	2,929	19,164
Constrained - GLU	3,563	104	283	2,485	5,123	3,667	3,160	2,987	21,371
Cons. - GLU & NGP	3,637	108	292	3,020	4,518	3,351	3,379	3,057	21,362

Table 73 shows that the daily passenger entries at Geelong station would increase from 2,400 in 2018, to 2,600 in 2021, 3,700 in 2031 and 4,400 in 2041 under the reference (TfV) land use (constrained model). With the GLU, the entries would increase to 5,100 in 2041. If there are no parking

spaces at Geelong station, the entries would reduce to 4,100 or -8% (TfV land use) and 4,500 or -10% (GLU).

Table 74 shows that for all individual stations, only the parking supply at Lara station would exceeded by the demand in 2018, and Geelong station parking supply would be exceeded by 2021. However, when considering the whole study area, all parking supply would only be exceeded by 2031.

Table 74 Summary of station parking demand (cars) (pivoted) under all scenarios

Station	Lara	Corio	North Shore	North Geelong	Geelong	South Geelong	Marshall	Waurm Ponds	Total
2018									
Parking supply	513	81	67	626	473	1091	500	403	3754
Parking demand	535	25	49	408	393	583	265	261	2,517
2021									
Unconstrained	558	20	85	384	494	579	213	152	2,486
Constrained	606	20	67	458	527	518	309	188	2,693
2031									
Unconstrained	1,031	17	54	554	657	808	914	495	4,530
Constrained	967	18	61	574	680	653	1,169	700	4,823
Constrained - NGP	993	19	71	853	-	771	1,326	734	4,768
2041									
Unconstrained	1,255	24	73	706	798	871	1,388	654	5,768
Constrained	1,313	21	74	714	777	831	1,343	682	5,755
Constrained - NGP	1,370	22	83	1,087	-	895	1,538	814	5,809
Constrained - GLU	1,800	20	74	940	902	917	1,349	758	6,760
Cons.- GLU & NGP	1,848	23	83	1,459	-	963	1,539	853	6,767

5.0 Summary and conclusions

This report presented the model validation for the 2016 base year in Chapter 3.0. The chapter concluded that the model performed at a satisfactory level and was fit for use to provide forecast for future years.

Chapter 4.0 presented the methodology used to forecast passenger travel demand by access mode, and parking demand to railway stations within the study area. The travel demand in terms of passenger entries for various scenarios in future was estimated by applying a pivot approach using the observed station entries from Myki data as the base and the growth from the model. The passenger entries were further split into six station access modes by time period. The parking demand in terms of park and ride drivers arriving at each station under various scenarios into the future was also estimated.

The future travel demand by access mode to study stations was estimated by using constrained and unconstrained models. Since the constrained models were able to forecast the redistribution of P&R demand due to change in parking supply, the constrained models were applied to study the impact of high population growth and removed parking supply at Geelong Station scenarios.

The model forecast indicates that the daily passenger entries to all study stations would increase from 8,900 in 2018 to 9,700 in 2021, 16,000 in 2031 and 20,100 (TfV land use) and 21,400 (Council land use) in 2041. Similarly, the number of parking demand is forecast to grow from 2,500 cars in 2018 to 2,700 in 2021, 4,800 in 2031 and 5,800 (TfV land use) and 6,800 (Council land use) in 2041.

With respect to Geelong station, the daily passenger entries would increase from 2,400 in 2018 to 2,600 in 2021, 4,000 in 2031 and 4,500 (TfV land use) and 5,100 (Council land use) in 2041. Correspondingly, the number of car parking demand is forecast to grow from 400 cars in 2018 to 500 in 2021, 700 in 2031, and 800 (TfV land use) and 900 (Council land use) in 2041. If the parking at Geelong Station was removed, model predicted that the P&R demand would shift to adjacent stations, and the other access modes at the station including K&R, Cycle, Walk and Bus would increase.

In considering the existing parking supply at the stations, only the parking supply at Lara station would exceeded by the demand in 2018, and Geelong station parking supply would be exceeded by 2021. However, when considering the whole study area, all parking supply would only be exceeded by 2031.

Detailed information on future travel demand by access mode to the study stations by time period was presented in Appendix B. The report also provides information on the forecast of highway traffic volumes, volume to capacity ratio during the AM peak period, and the overall network performance statistics in Appendix C and D.

In conclusion, this report has provided necessary information on the future patronage by access mode and parking demand at the study railway stations. The information can be used to develop options for improving parking and access to each of the study railway stations to inform Geelong Commuter Car Parking Strategy.

Appendix A

Pivot Approach

Appendix A Pivot Approach

The pivoting methodology used in the estimation of the daily station entries follow the revised 8-cases method developed by Andrew Daly, James Fox, Bhanu Patruni, and Frank Milthorpe, published in the 2012 Australasian Transport Research Forum¹.

The eight possible cases and the recommended treatments are set out in the table below.

Table 75 Eight possible cases

Base (B)	Synthetic Base (S _b)	Synthetic Future (S _f)	Predicted (P)		Cell Type
0	0	0	0		1
0	0	>0	S _f		2
0	>0	0	0		3
0	>0	0 < S _f < X ₁	Normal growth	0	4
		>X ₁	Extreme growth	S _f - X ₁	
>0	0	0	B		5
>0	0	>0	B + S _f		6
>0	>0	0	0		7
>0	>0	0 < S _f < X ₂	Normal growth	B . S _f / S _b	8
		>X ₂	Extreme growth	B.X ₂ / S _b + (S _f - X ₂)	

To complete the specification of the calculation, it is necessary to specify the X variables and to define when a cell is considered to be zero (our experience has led us to use a test value of 10⁻³).

In the extreme growth cases (4) and (8), it can be seen that the standard factor function is used initially, up to the limit when S_f is X₁ (case 4) or X₂ (case 8), and from that point an absolute growth is applied. In case (4) the starting point for absolute growth is 0, in case (8) it is B . X₂ / S_b.

The definitions for X₁ and X₂, using parameters k₁ and k₂, are given by:

$$X_1 = k_2 \cdot S_b$$

$$X_2 = S_b \cdot \{ k_1 + \max (k_2 \cdot S_b / B, k_1) \}$$

where: k₁, k₂ > 0²

¹ http://atrf.info/papers/2012/2012_Daly_Fox_Patruni_Milthorpe.pdf

² The values k₁ = 0.5 and k₂ = 5 are commonly used.

Appendix B

Station entries by
access mode by time
period

Appendix B Station entries by access mode by time period

Table 76 2018 Observed passenger entries by access mode by time period (pivoted and unconstrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	323	102	0	19	85	52	121	37	8	4	33	41	52	14	11	1	16	35	182	55	12	6	48	112
CORIO	8	2	0	0	2	1	12	4	1	0	3	4	12	3	3	0	4	8	10	3	1	0	3	6
NORTH SHORE	22	5	0	1	6	29	20	4	0	2	14	22	15	2	0	1	22	11	14	3	0	3	21	11
NORTH GEELONG	267	68	3	8	36	52	94	27	1	6	47	29	34	15	0	5	72	29	93	27	1	21	169	72
GEELONG	145	53	6	29	134	41	188	65	8	34	272	70	202	60	11	29	457	94	120	42	5	33	264	57
SOUTH GEELONG	308	154	46	9	42	77	161	93	31	9	70	35	65	55	21	6	100	5	228	132	44	33	267	14
MARSHALL	146	46	0	4	17	51	52	20	0	1	12	18	18	11	0	1	9	6	134	52	0	7	55	37
WAURN PONDS	116	89	2	7	31	24	98	49	6	6	49	11	50	39	7	4	62	0	93	47	6	11	90	0
Total	1,334	519	58	77	352	326	746	299	55	62	500	230	449	199	52	47	741	187	875	360	69	113	917	309

Table 77 2021 passenger entries by access mode by time period (pivoted and unconstrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	351	111	0	0	0	154	107	32	7	0	0	115	9	2	2	0	0	124	200	60	14	1	9	162
CORIO	7	2	0	0	1	4	9	3	1	0	3	9	1	0	0	0	3	27	8	2	1	0	2	10
NORTH SHORE	45	11	0	0	1	8	37	8	0	0	3	18	2	0	0	1	15	36	5	1	0	1	4	43
NORTH GEELONG	307	78	4	1	3	84	60	17	1	1	9	135	12	5	0	1	17	132	34	10	0	4	33	335
GEELONG	191	70	8	23	106	46	183	64	8	30	242	167	36	11	2	23	363	492	241	84	10	9	76	148
SOUTH GEELONG	382	191	57	7	32	28	152	88	29	11	91	61	0	0	0	10	160	108	90	52	17	34	273	318
MARSHALL	147	46	0	1	5	102	43	17	0	3	26	29	9	6	0	1	18	17	47	18	0	14	112	131
WAURN PONDS	94	72	2	1	5	124	44	22	3	5	42	127	3	3	0	7	106	57	29	15	2	9	74	144
Total	1,523	580	71	34	153	550	636	250	49	51	416	661	74	27	4	44	683	992	652	242	44	72	584	1,291

Table 78 2031 passenger entries by access mode by time period (pivoted and unconstrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	633	200	0	0	0	165	218	66	15	0	1	125	18	5	4	0	0	196	360	109	25	2	15	214
CORIO	7	2	0	0	2	4	6	2	0	1	6	11	0	0	0	0	5	26	7	2	0	0	3	11
NORTH SHORE	32	7	0	0	1	9	20	4	0	0	4	21	3	0	0	1	10	27	3	1	0	0	3	33
NORTH GEELONG	433	110	5	1	4	106	99	28	1	2	12	168	1	0	0	2	29	201	45	13	1	6	45	466
GEELONG	237	87	10	44	202	86	261	91	11	50	405	223	74	22	4	36	559	697	318	110	13	19	154	237
SOUTH GEELONG	506	253	76	9	43	36	202	117	39	15	120	80	0	0	0	14	213	141	200	116	39	37	302	346
MARSHALL	612	193	0	4	20	128	178	69	0	7	53	64	22	14	0	4	66	56	249	97	0	37	297	340
WAURN PONDS	278	214	5	2	9	161	151	75	9	10	81	221	9	7	1	13	211	156	132	66	8	15	125	266
Total	2,737	1,065	96	62	282	695	1,135	452	76	84	681	912	126	48	9	70	1,094	1,500	1,315	513	86	117	943	1,912

Table 79 2041 passenger entries by access mode by time period (pivoted and unconstrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	768	242	0	0	0	158	268	81	18	0	1	129	23	6	5	0	1	227	440	132	30	3	28	214
CORIO	10	3	0	0	2	5	8	2	1	1	8	15	1	0	0	0	7	35	11	3	1	0	3	13
NORTH SHORE	43	10	0	0	1	12	27	6	0	1	6	28	4	1	0	1	15	35	6	1	0	1	4	43
NORTH GEELONG	543	138	7	1	5	134	128	37	2	2	15	206	1	0	0	2	38	250	69	20	1	7	59	568
GEELONG	290	106	12	57	258	121	314	109	13	65	523	294	94	28	5	44	683	911	388	135	16	26	214	299
SOUTH GEELONG	537	269	81	14	65	56	220	128	43	17	137	90	0	0	0	15	234	158	227	131	44	42	336	373
MARSHALL	952	301	0	5	23	127	250	97	0	10	83	105	28	17	0	6	98	89	373	145	0	54	439	486
WAURN PONDS	380	292	7	2	10	159	198	99	12	12	95	280	11	8	1	15	233	235	152	76	10	18	144	378
Total	3,523	1,360	107	80	365	772	1,413	558	89	107	867	1,148	161	61	11	84	1,308	1,940	1,665	644	101	152	1,227	2,374

Table 80 2021 passenger entries by access mode by time period (pivoted and constrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	375	118	0	0	0	127	128	39	9	0	0	88	11	3	2	0	0	122	207	62	14	1	12	153
CORIO	8	3	0	0	1	3	8	2	1	0	4	10	1	0	0	0	3	26	8	2	1	0	2	10
NORTH SHORE	37	9	0	0	2	17	24	5	0	1	6	29	3	0	0	1	14	35	12	2	0	1	5	33
NORTH GEELONG	344	87	4	0	2	43	113	32	1	0	4	75	13	6	0	1	19	130	1	0	0	4	33	382
GEELONG	234	86	10	15	70	28	170	59	7	30	243	182	36	11	2	24	368	486	244	85	10	9	70	147
SOUTH GEELONG	365	182	55	9	42	36	148	85	28	11	89	66	0	0	0	10	158	106	12	7	2	40	327	387
MARSHALL	177	56	0	1	4	67	46	18	0	3	24	27	10	6	0	1	17	18	173	67	0	4	33	46
WAURN PONDS	107	82	2	1	5	103	65	32	4	4	35	104	4	3	0	7	107	57	33	17	2	9	76	137
Total	1,646	623	71	28	126	423	701	273	50	50	406	581	76	29	5	44	687	981	690	243	29	69	557	1,295

Table 81 2031 passenger entries by access mode by time period (pivoted and constrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	596	188	0	0	0	123	206	62	14	0	1	103	18	5	4	0	0	175	329	99	23	3	21	184
CORIO	7	2	0	0	2	3	7	2	1	1	5	9	0	0	0	0	5	26	7	2	0	0	3	10
NORTH SHORE	36	8	0	0	2	16	18	4	0	1	7	34	3	1	0	1	13	35	14	3	0	1	5	29
NORTH GEELONG	438	111	6	1	3	45	136	39	2	1	6	100	1	0	0	2	28	182	2	1	0	5	39	480
GEELONG	298	109	13	29	134	39	234	81	10	45	368	233	72	21	4	33	521	649	297	103	12	18	145	218
SOUTH GEELONG	463	232	70	14	63	37	189	110	37	14	114	82	0	0	0	13	200	137	0	0	0	54	438	495
MARSHALL	705	223	0	3	14	37	160	62	0	8	68	81	24	15	0	4	65	58	607	236	0	9	74	119
WAURN PONDS	368	283	7	2	8	95	257	128	16	7	59	157	10	8	1	16	246	171	151	75	9	18	147	297
Total	2,912	1,156	94	49	225	396	1,207	488	79	77	626	800	129	50	9	69	1,077	1,432	1,408	520	45	108	870	1,832

Table 82 2041 passenger entries by access mode by time period (pivoted and constrained model)

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	804	254	0	0	0	121	285	86	20	0	1	110	26	7	5	0	1	224	447	135	31	4	36	202
CORIO	9	3	0	0	2	3	7	2	1	1	7	12	1	0	0	0	6	30	10	3	1	0	3	11
NORTH SHORE	44	10	0	1	3	19	20	4	0	1	9	42	5	1	0	1	17	40	20	4	0	1	7	32
NORTH GEELONG	543	138	7	1	3	44	169	48	2	1	7	119	1	0	0	2	36	220	3	1	0	6	49	584
GEELONG	360	132	15	38	172	39	239	83	10	60	489	298	88	26	5	39	613	810	355	123	15	24	192	257
SOUTH GEELONG	576	288	86	18	81	41	256	148	49	15	120	89	0	0	0	16	248	170	0	0	0	68	549	607
MARSHALL	830	262	0	6	26	38	172	67	0	11	87	114	23	14	0	5	79	76	681	265	0	15	118	159
WAURN PONDS	423	325	8	2	9	78	182	91	11	12	100	294	10	8	1	15	235	231	153	77	10	18	143	372
Total	3,590	1,411	116	65	296	384	1,330	529	93	101	820	1,078	154	56	12	79	1,234	1,800	1,669	607	56	135	1,095	2,224

Table 83 2041CC -CP_GLU

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	1076	340	0	0	0	85	400	121	27	0	0	89	59	15	12	0	1	248	647	195	44	3	23	177
CORIO	8	2	0	0	2	3	6	2	0	1	8	11	2	0	0	0	6	26	13	4	1	0	2	6
NORTH SHORE	44	10	0	1	3	20	22	5	0	2	15	34	3	0	0	2	30	28	15	3	0	2	14	29
NORTH GEELONG	692	175	9	1	2	43	247	70	3	0	3	110	23	10	0	2	34	256	2	1	0	9	75	718
GEELONG	435	159	18	37	169	45	242	84	10	64	514	435	78	23	4	41	647	1012	448	156	19	21	173	287
SOUTH GEELONG	613	306	92	20	89	45	304	176	59	11	87	87	0	0	0	16	251	197	0	0	0	72	582	655
MARSHALL	871	275	0	5	23	32	125	48	0	14	116	163	23	14	0	5	76	87	707	275	0	12	98	191
WAURN PONDS	454	349	8	2	9	76	228	114	14	11	92	276	16	12	2	14	225	263	152	76	10	18	142	424
Total	4,193	1,617	127	65	298	349	1,574	620	114	103	836	1,204	203	76	19	81	1,269	2,117	1,984	709	73	137	1,109	2,486

Table 84 2031 CC - No parking space at Geelong Station

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	609	192	0	0	0	125	215	65	15	0	0	98	19	5	4	0	0	179	336	101	23	3	21	187
CORIO	8	2	0	0	1	3	7	2	0	1	5	10	0	0	0	0	5	26	8	3	1	0	2	9
NORTH SHORE	38	9	0	0	2	17	23	5	0	1	6	32	3	0	0	1	15	35	20	4	0	1	5	25
NORTH GEELONG	538	136	7	0	2	38	175	50	2	0	3	108	28	12	0	1	14	199	253	72	3	1	7	293
GEELONG	10	4	0	80	366	102	3	1	0	57	464	353	1	0	0	31	493	652	18	6	1	31	253	409
SOUTH GEELONG	454	227	68	12	53	32	224	130	43	8	67	53	13	11	4	9	142	158	171	99	33	28	227	395
MARSHALL	765	242	0	3	14	40	192	75	0	8	62	75	34	21	0	4	66	55	722	281	0	6	50	72
WAURN PONDS	390	299	7	2	8	86	246	123	15	9	71	183	12	9	2	16	257	174	191	96	12	18	142	266
Total	2,811	1,111	82	98	447	442	1,087	451	76	84	680	911	109	58	10	63	993	1,477	1,721	662	73	87	707	1,656

Table 85 2041 CC - No parking space at Geelong Station

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	835	264	0	0	0	122	300	91	21	0	1	107	27	7	6	0	1	232	465	140	32	5	37	207
CORIO	9	3	0	0	2	3	7	2	0	1	7	12	1	0	0	0	6	30	11	3	1	0	3	10
NORTH SHORE	46	11	0	1	3	20	24	5	0	1	10	40	4	1	0	1	20	40	26	5	0	1	6	27
NORTH GEELONG	666	169	8	1	3	42	241	69	3	0	3	102	32	14	0	1	20	247	328	94	4	1	9	340
GEELONG	10	4	0	104	473	100	3	1	0	71	571	432	1	0	0	38	602	803	22	7	1	40	323	489
SOUTH GEELONG	540	270	81	12	57	31	246	142	47	11	92	76	20	17	6	10	163	178	207	120	40	33	266	452
MARSHALL	909	287	0	6	26	38	209	81	0	10	81	109	27	17	0	5	85	80	823	320	0	11	86	108
WAURN PONDS	440	338	8	2	10	84	270	135	17	9	71	220	13	10	2	16	249	233	201	101	13	17	139	335
Total	3,456	1,345	98	126	574	439	1,300	526	89	103	836	1,099	124	65	14	73	1,146	1,842	2,083	791	90	107	868	1,970

Table 86 2041 CC - No parking space at Geelong Station - Council Land use

Station	AM						IP						PM						OP					
	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk	P&R_D	K&R	P&R_P	Cycle	PT	Walk
LARA	1098	347	0	0	0	87	417	126	29	0	0	80	61	16	12	0	1	252	662	200	45	3	22	179
CORIO	8	3	0	0	2	3	8	3	1	1	7	10	2	0	0	0	6	27	13	4	1	0	2	6
NORTH SHORE	46	11	0	1	3	20	27	6	0	2	13	32	3	0	0	2	32	29	20	4	0	2	14	26
NORTH GEELONG	850	215	11	0	2	42	320	91	4	0	2	109	56	24	0	1	21	293	536	153	7	1	7	275
GEELONG	11	4	0	113	516	117	5	2	0	69	561	553	1	0	0	39	605	949	20	7	1	39	317	588
SOUTH GEELONG	582	291	87	13	57	34	274	158	53	10	83	84	20	17	6	10	163	208	205	119	40	31	255	550
MARSHALL	930	294	0	6	26	34	187	73	0	12	94	134	25	16	0	5	81	91	831	323	0	9	73	135
WAURN PONDS	465	357	8	2	10	77	271	136	17	9	74	246	15	12	2	15	238	263	227	114	14	15	124	347
Total	3,990	1,521	107	135	616	415	1,509	594	103	103	834	1,247	182	85	21	73	1,146	2,111	2,515	923	108	101	815	2,106

Appendix C

Highway traffic volumes

Appendix C Highway traffic volumes

Highway traffic volumes

Total one-way weekday highway modelled volumes for the constrained scenarios 2016, 2021, 2031, 2041 (using TfV land use) and 2041 GLU , 2041 GLU& NGP (using Geelong Council land use) are shown in **Error! Not a valid bookmark self-reference.** to Figure 26 respectively, using bandwidths, with thicker bands representing higher traffic volumes. The highway modelled volumes for the 2031 and 2031 NGP are not significantly different, therefore the highway modelled volumes for 2031 NGP are not presented. Similarly the highway volumes for 2041 NGP are also not presented.

Highway traffic volumes differences

Total one-way volume differences between the future year scenarios (2021, 2031, and 2041) and Base year (2016) are shown in Figure 27 to Figure 29. Red bands reflect an increase and green bands reflect a decrease in total weekday traffic volumes. Similarly, total one-way volume differences between Geelong land use scenarios (2041GLU and 2041GLU&NGP) and 2041 Base are shown in Figure 30 and Figure 31 respectively.

Highway volume to capacity ratios

The ratio between link volume and link capacity in the AM-peak 2 hour time period for all constrained scenarios is shown in Figure 32 to Figure 36. These figures show the main congestion points on the Geelong network under these scenarios. They indicate that congestion is forecast to grow on the roads around the Geelong CBD, roads to the east and roads to the south of Geelong.

Figure 21 Total one-way vehicle modelled daily volumes for 2016

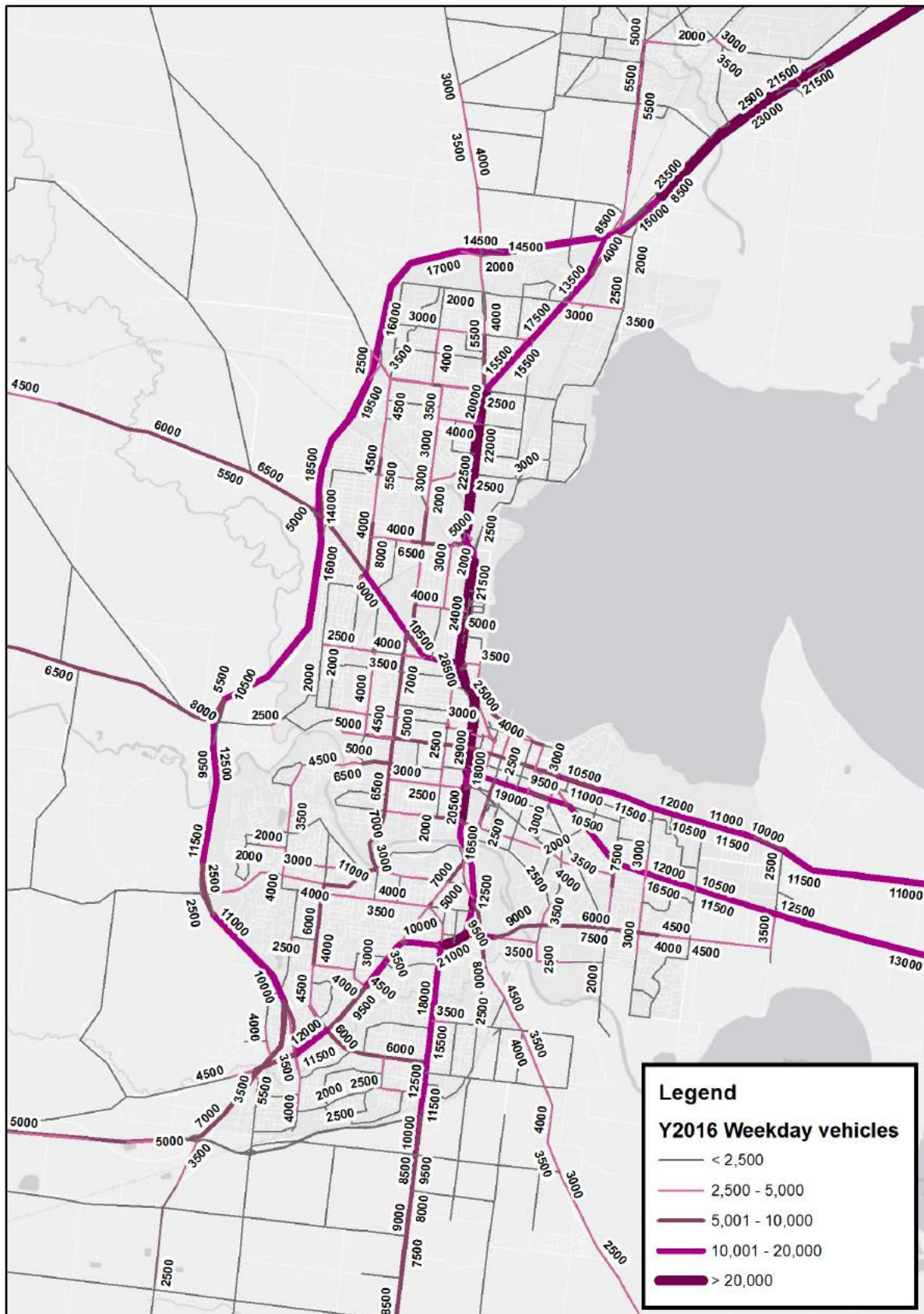


Figure 22 Total one-way vehicle modelled daily volumes for 2021

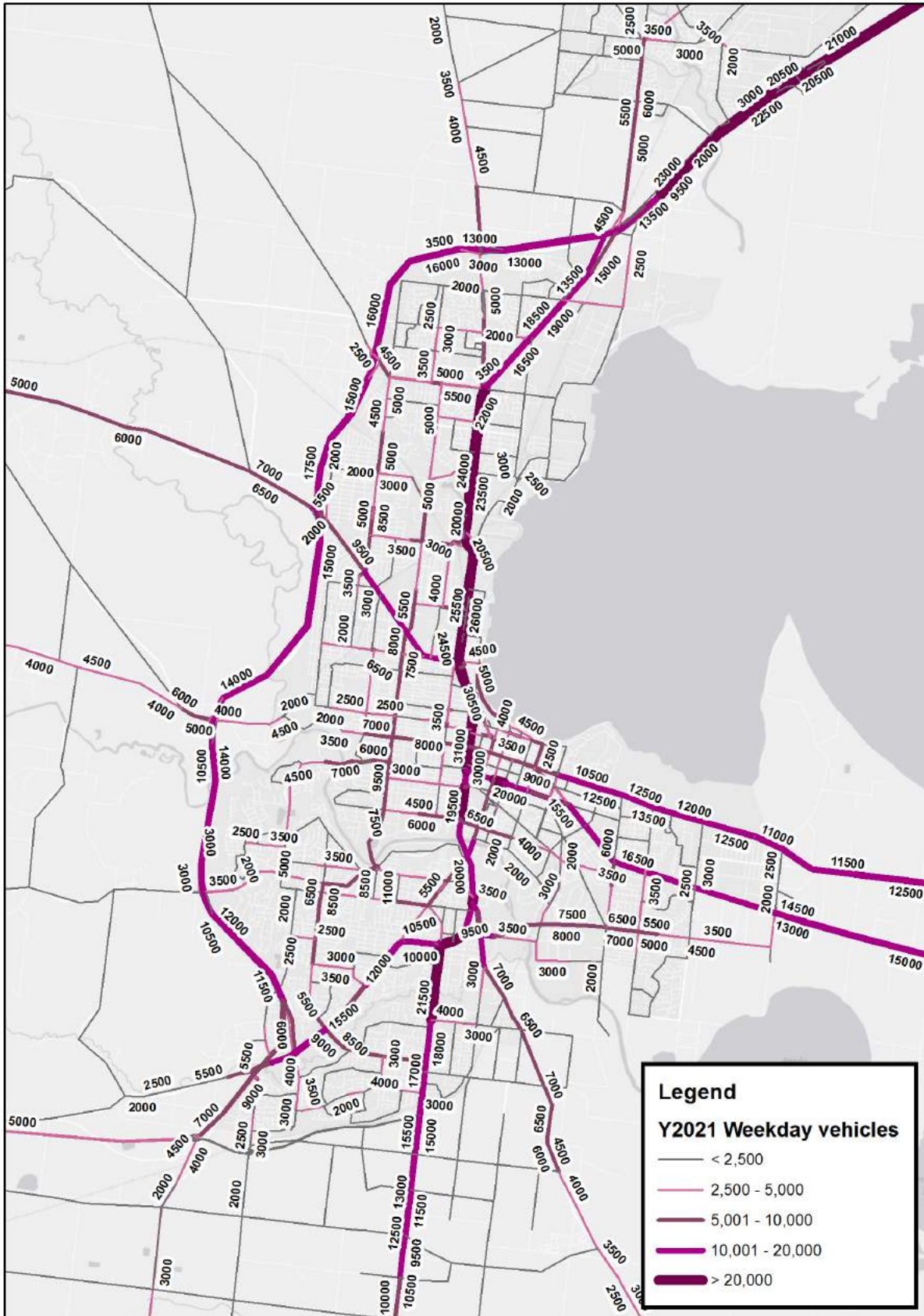


Figure 23 Total one-way vehicle modelled daily volumes for 2031

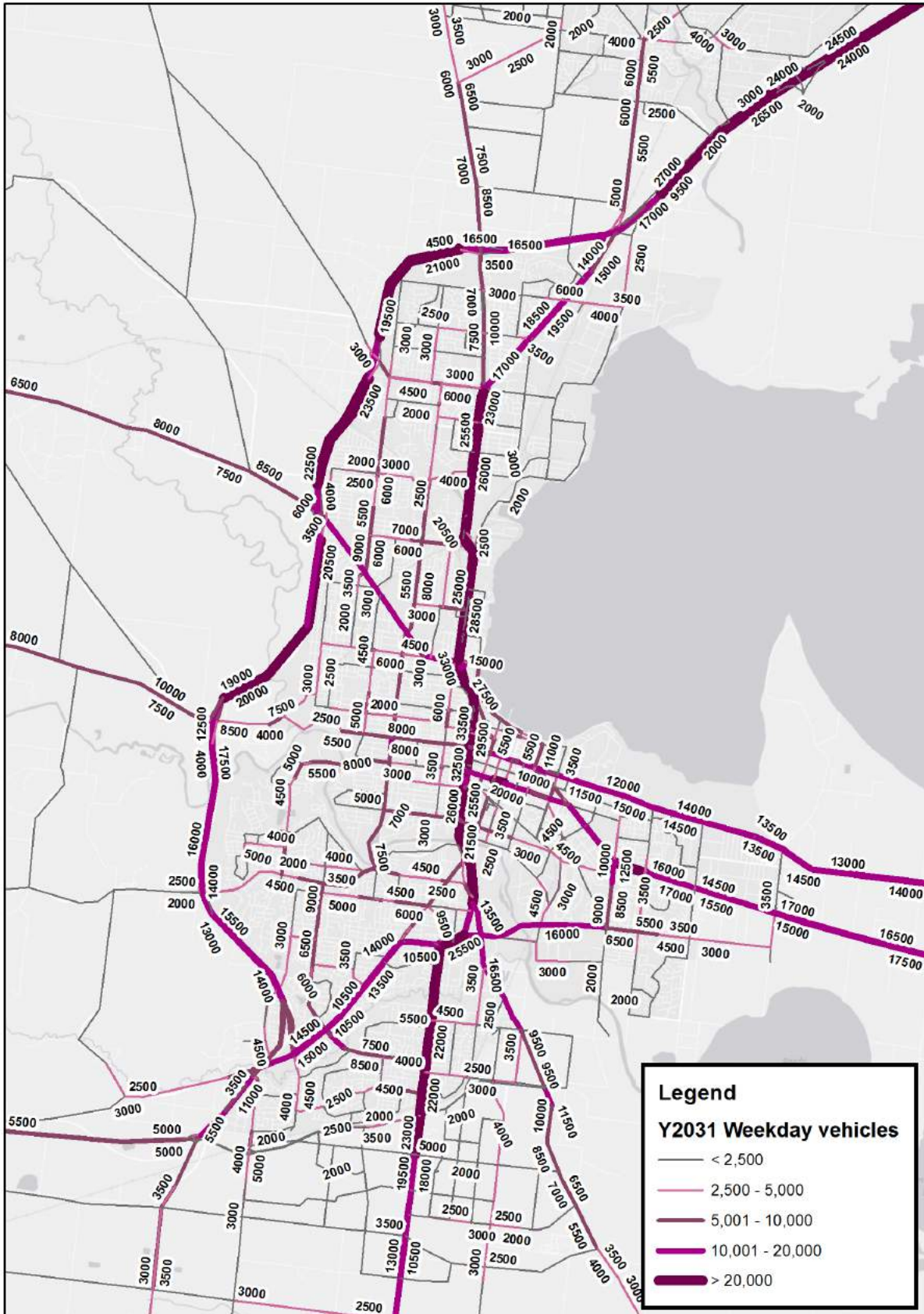


Figure 24 Total one-way vehicle modelled daily volumes for 2041

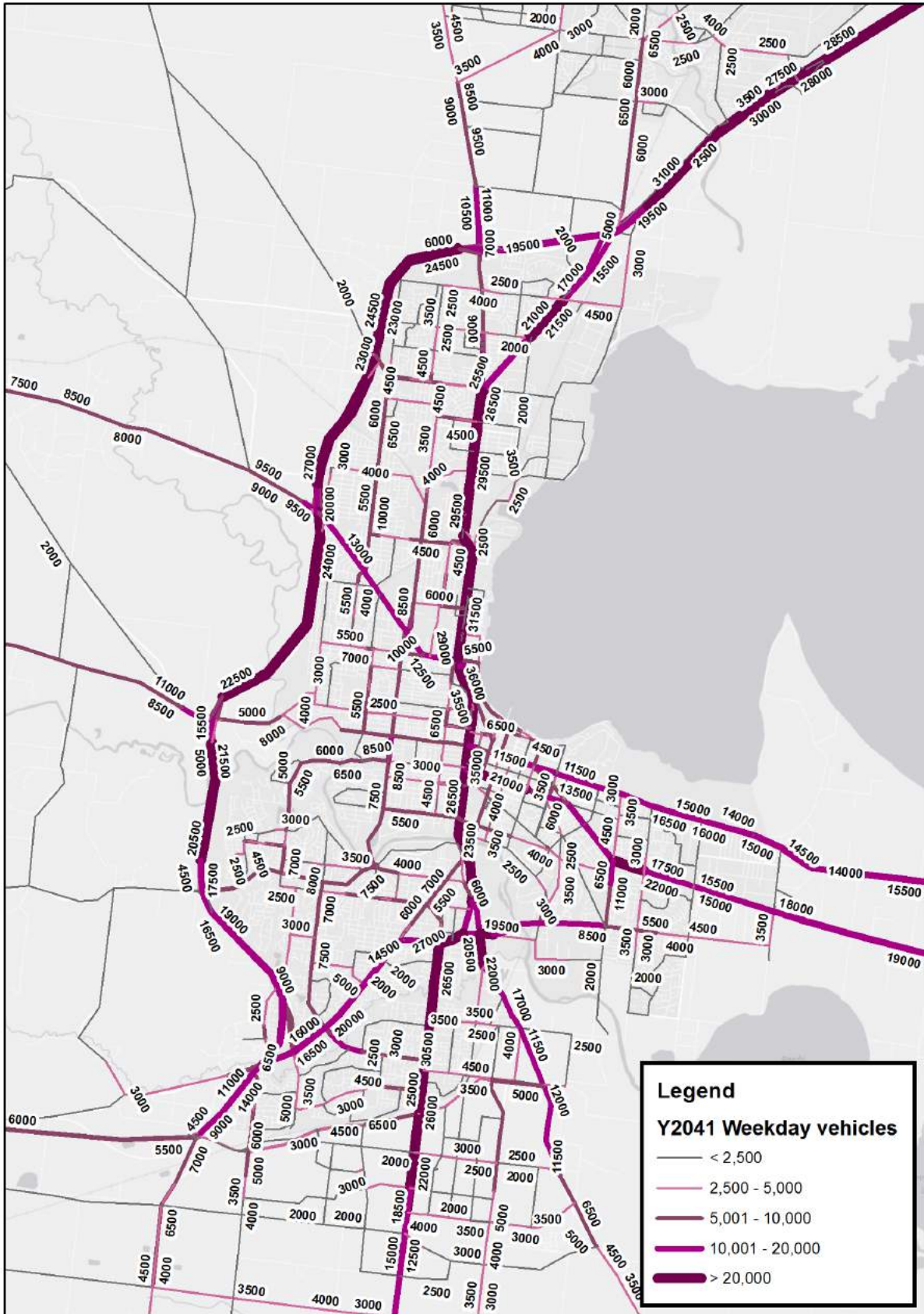


Figure 25 Total one-way vehicle modelled daily volumes for 2041 (Geelong Council land use (GLU))

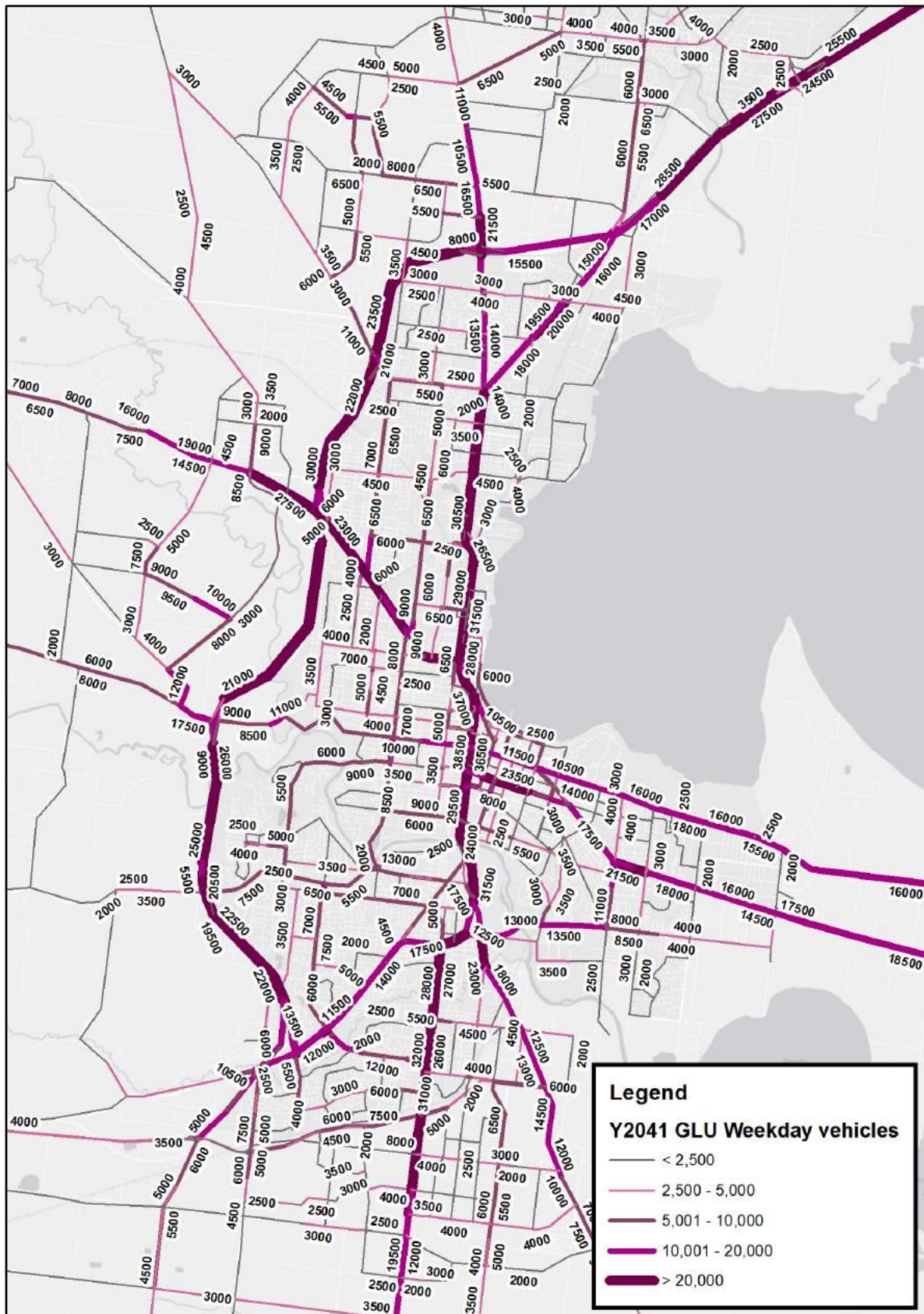


Figure 26 Total one-way vehicle modelled daily volumes for 2041 (GLU & NGP)

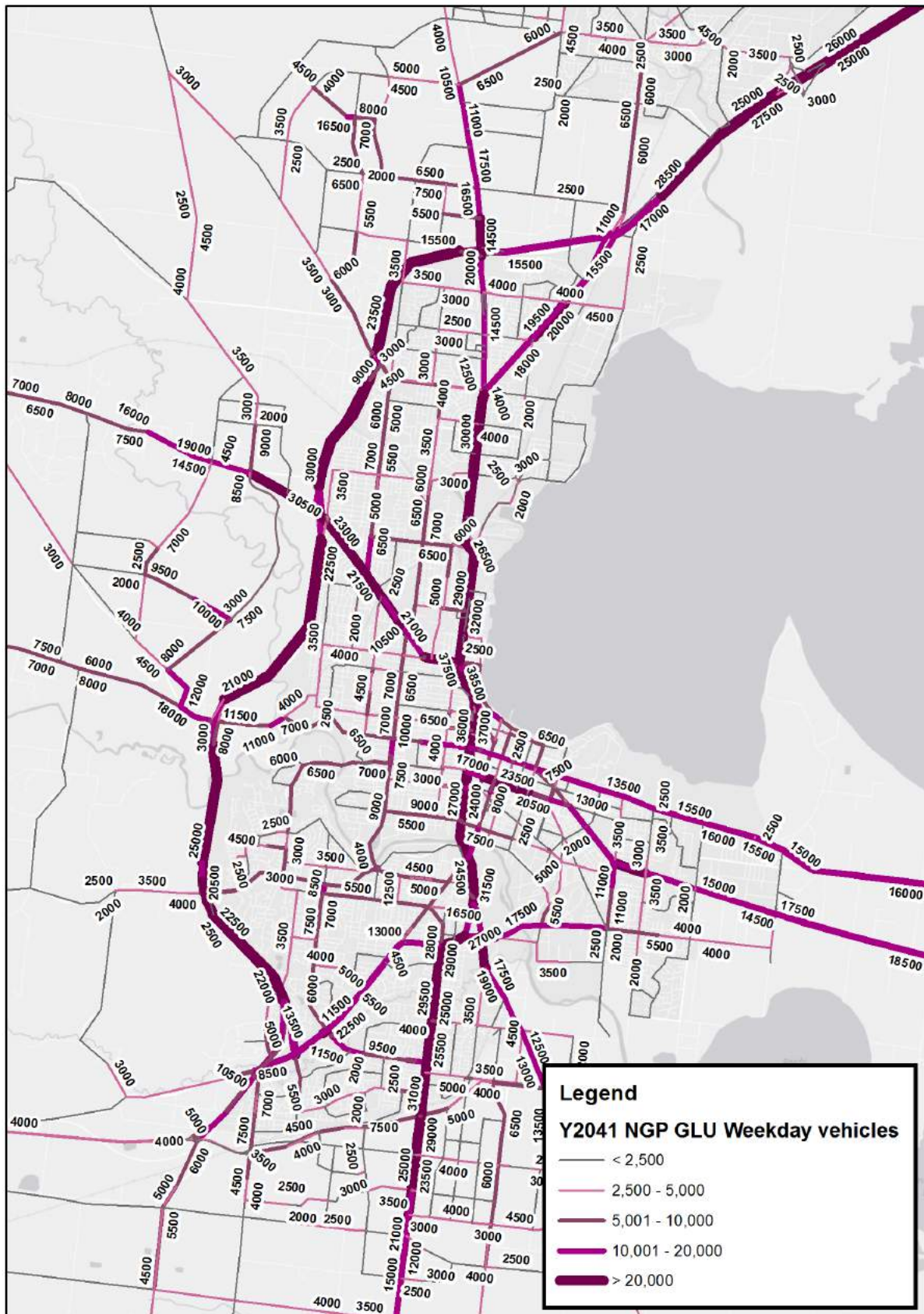


Figure 27 Differences between 2021 and 2016 (base) one-way vehicle modelled daily volumes



Figure 28 Differences between 2031 and 2016 (base) one-way vehicle modelled daily volumes



Figure 29 Differences between 2041 and 2016 (base) one-way vehicle modelled daily volumes



Figure 30 Differences between 2041 (GLU) and 2041 (base) one-way vehicle modelled daily volumes



Figure 31 Differences between 2041 (GLU & NGP) and 2041 (base) one-way vehicle modelled daily volumes



Figure 32 AM peak 2 hour volume to capacity ratios for 2016

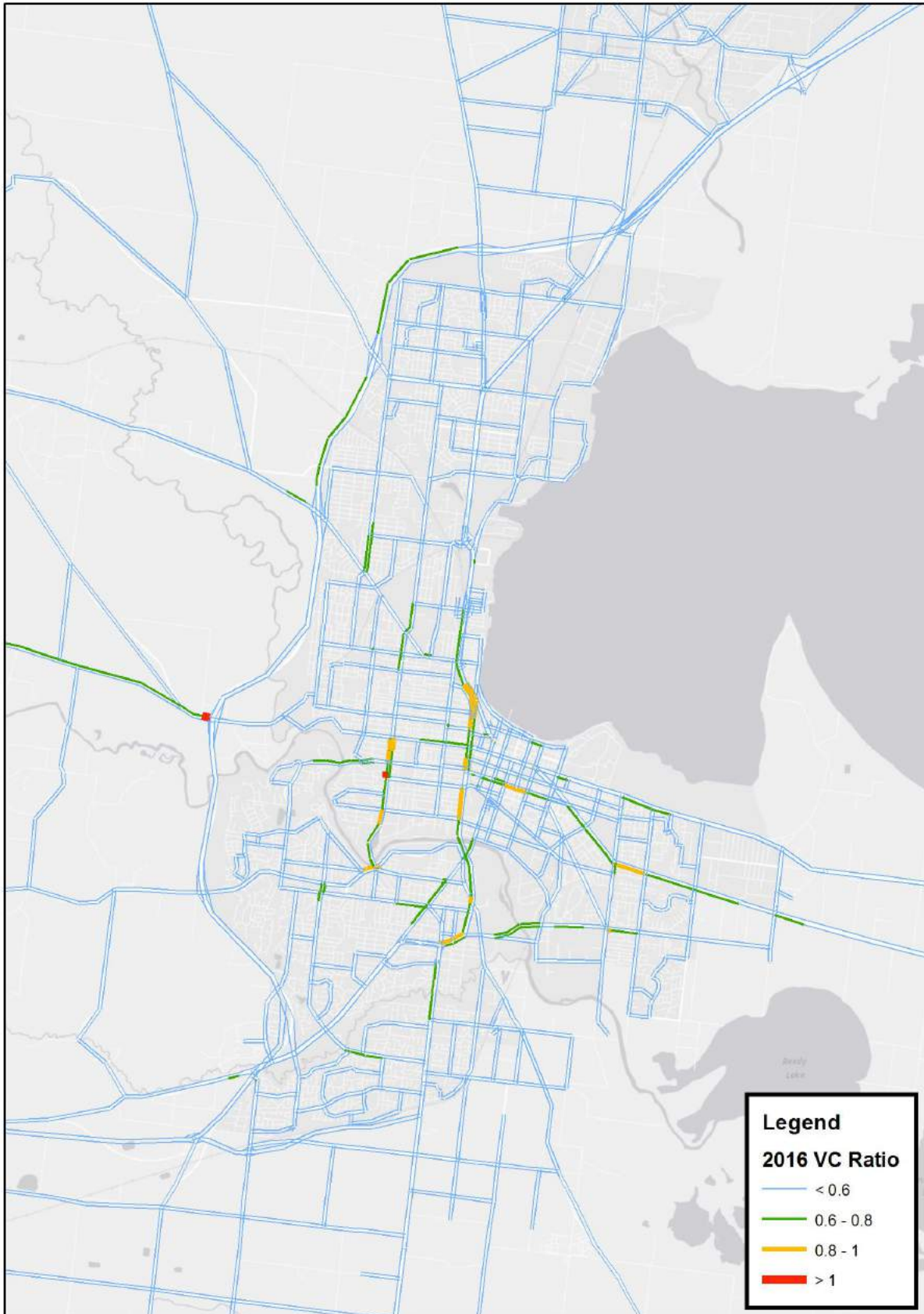


Figure 33 AM peak 2 hour volume to capacity ratios for 2021

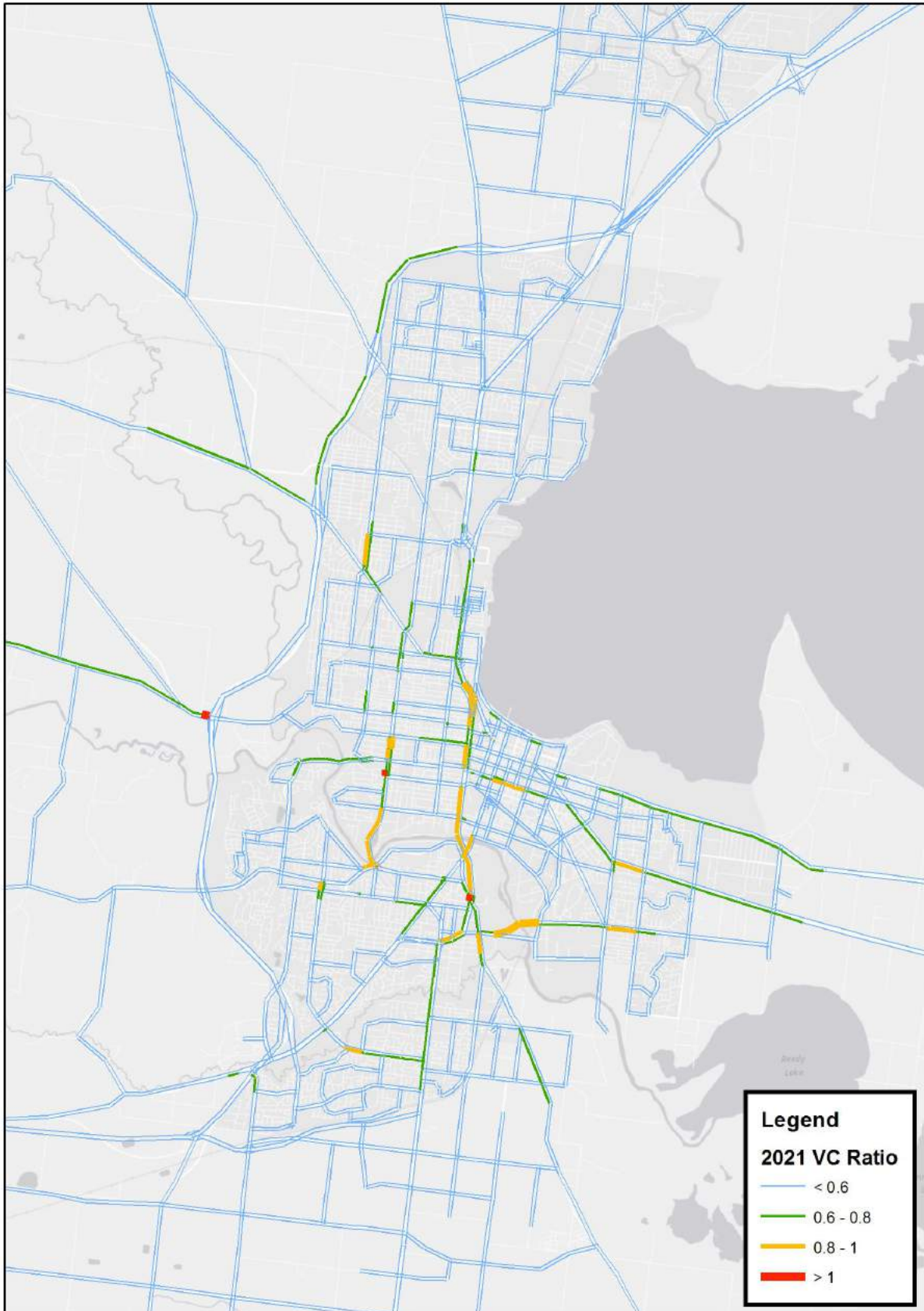


Figure 34 AM peak 2 hour volume to capacity ratios for 2031

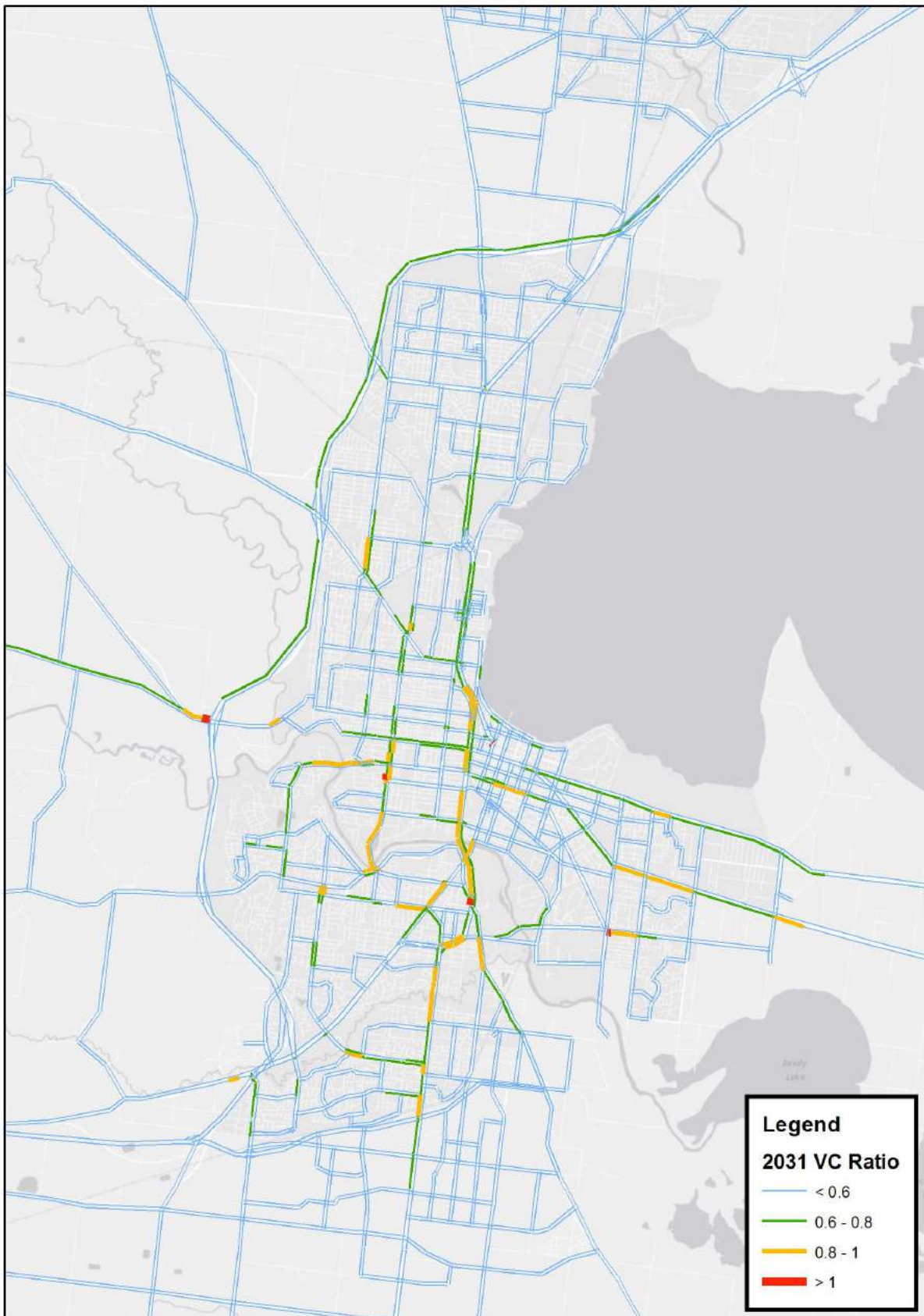


Figure 35 AM peak 2 hour volume to capacity ratios for 2041

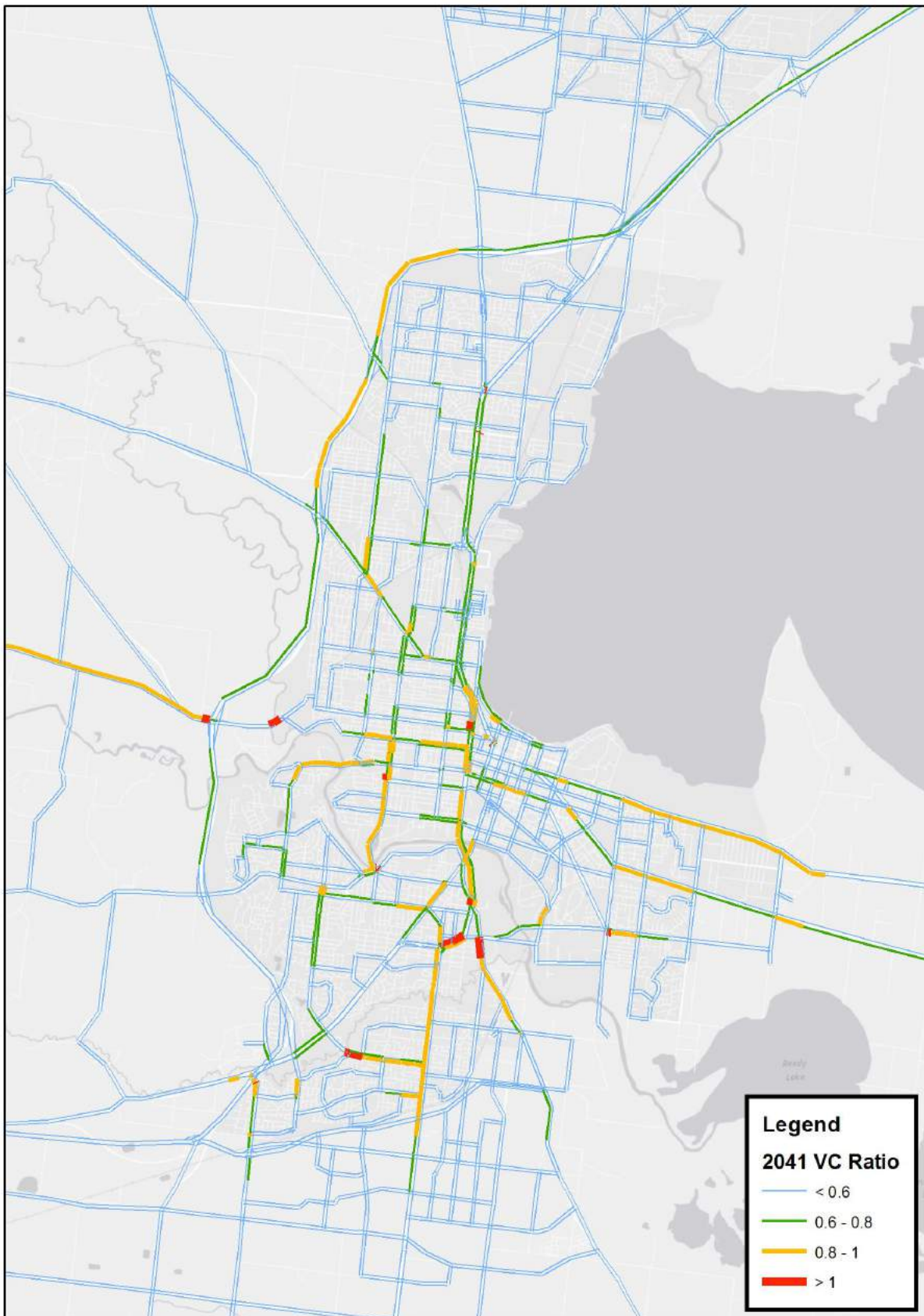
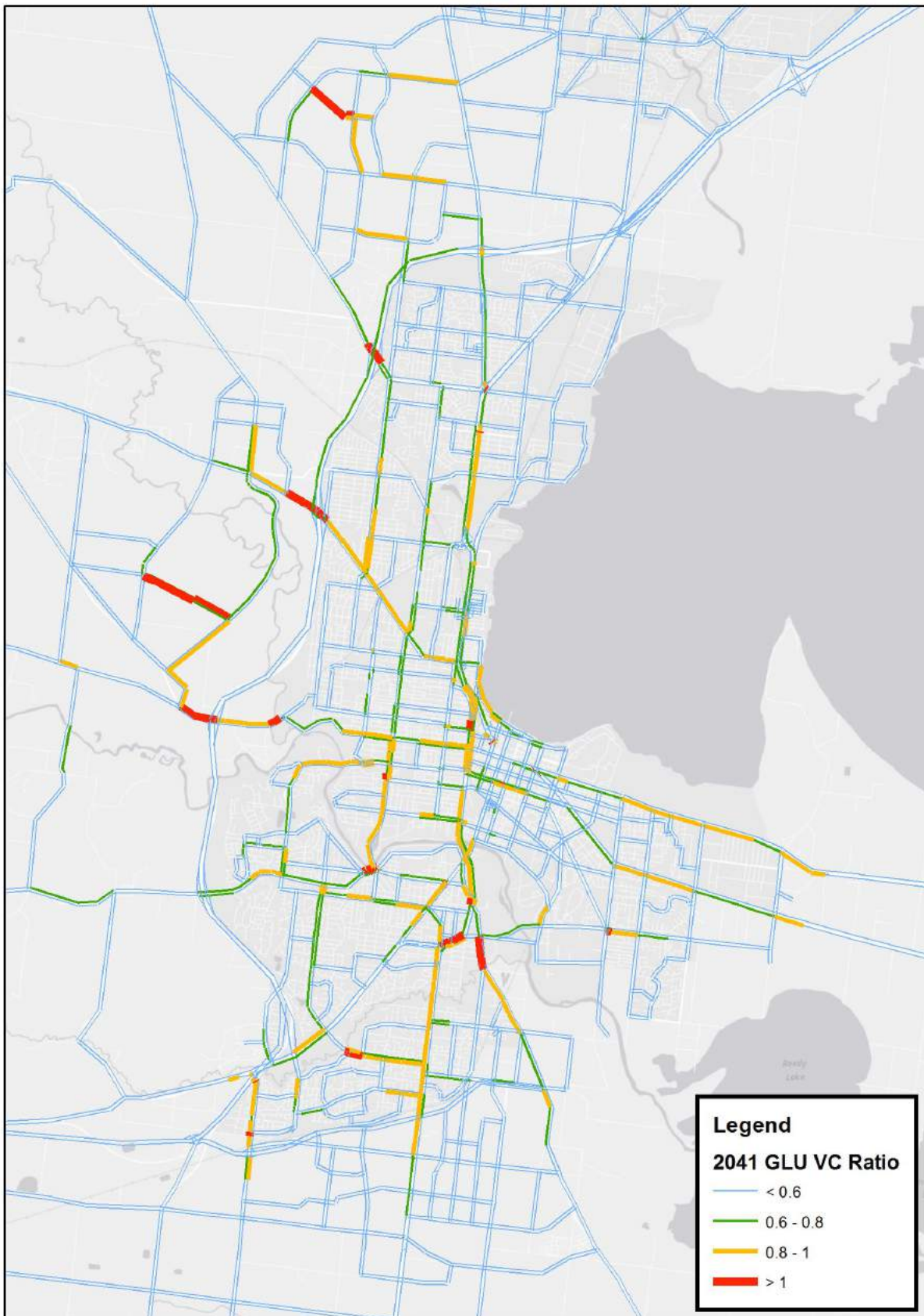


Figure 36 AM peak 2 hour volume to capacity ratios for 2041 (GLU)



Appendix D

Highway network
performance

Appendix D Highway network performance

This Appendix presents the network performance for the constrained scenarios described in Section 4.5. They include:

- Total VKT, the total vehicle kilometres travelled for an average weekday
- Congested VKT, the vehicle kilometres travelled in conditions where the volume to capacity ratio was greater than 0.8
- Percentage of VKT congested, the percentage of all vehicle kilometres travelled in congested conditions (where the volume to capacity ratio was greater than 0.8), calculated by congested VKT divided by total VKT
- Total VHT, the total vehicle hours travelled on an average weekday
- Mean trip speed, the average speed for an average weekday, calculated by Total VKT divided by Total VHT

These global network indicators are designed to estimate the impact on the network as a whole. However, they do not necessarily indicate the best utilisation of the network as they do not consider the functional classification of individual roads.

A summary of the network performance for the scenarios for the AM peak period is shown in Table 87. The table shows the total demand for road transport grows from 2016 to 2041 and under different scenarios. Table 87 shows the average speed on the network will gradually reduce over the years, and would further reduce under the GLU scenario due to the increase in traffic congestion. Similarly, the percentage of travel undertaken in congested conditions will increase from 2.2% in 2016 to 3.6% in 2021, 5.1% in 2031 and 11.1% in 2041, and 12.7% in 2041 with Council land use, which given the growth in total travel means there is forecast to be about five times as much congestion experienced in the 2041 compared to 2016.

Table 87 Global network performance for all scenarios

Network performance (AM peak period)	2016	2021	2031	2031 NGP	2041	2041 NGP	2041 GLU	2041 NGP & GLU
Total VKT (kms) x1000	806	876	1,029	1,028	1,175	1,176	1,227	1,229
Congested VKT (kms) x 1000	18	32	52	51	131	131	156	158
% of VKT congested	2.2%	3.6%	5.1%	4.9%	11.1%	11.1%	12.7%	12.8%
Total VHT (hrs) x 1000	14.6	106	129	128	151	151	167	167
Mean trip speed (km/hr)	55.2	54.1	53.3	53.3	51.3	51.4	47.2	47.3

Table 88 shows some overall demand statistics for movements from, to and through the Geelong model study area for all constrained scenarios. This shows that there is a relatively low public transport mode share now and into the future. The public transport mode share slightly increases to the long term future but levels of personal vehicle congestion are not enough to course any significant shift.

Table 88 Demand statistics for the Base Case

Statistics	2016	2021	2031	2031 NGP	2041	2041 NGP	2041 GLU	2041 NGP & GLU
Private car trips	855	957	1,143	1,139	1,338	1,338	1,588	1,588
Total truck trips	8	8	9	9	10	10	8	8
Public Transport trips	17.2	19.4	25.2	25.2	30.3	30.2	33.5	33.2
PT mode share	2.0%	2.0%	2.2%	2.2%	2.3%	2.3%	2.1%	2.1%

Appendix H

Short Term Plan Cost Estimates

Geelong Commuter Car Parking Strategy - Short Term Plan Estimate

Lara, North Shore, North Geelong, Marshall, Waurn Ponds

Geelong Commuter Car Parking Strategy - Short Term Plan Estimate

Lara, North Shore, North Geelong, Marshall, Waurn Ponds

Client: Transport for Victoria

ABN: N/A

Prepared by

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Quality Information

Document Geelong Commuter Car Parking Strategy - Short Term Plan Estimate

Ref TBA

Date 07-Dec-2018

Prepared by Alvin Cruz

Reviewed by Jane Northey

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	07-Dec-2018	Draft Concept Estimate	Jane Northey Associate Director	

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1.0 Introduction

This report provides a concept estimate for the short term plan of the Geelong Commuter Car Parking Strategy for Transport for Victoria (TfV) . Five train station parking lots are considered in the short term plan, namely: Lara, North Shore, North Geelong, Marshall and Waurn Ponds.

2.0 Scope of Project

The short term plan for the Geelong Commuter Car Parking Strategy involves five train station parking: Lara, North Shore, North Geelong, Marshall and Waurn Ponds. The scope and cost summary are as follows:

Table 1. Summary of Site Areas and Parking Spots

Stations	SITE AREAS (m2)			CAR PARKING (no)			
	Existing	Addition	TOTAL AREA	Existing surfaced	Existing gravel	Addition	TOTAL SPOTS
LARA	20,900	20,900	34,000	589	50	490	1,129
NORTH SHORE	11,000	5,000	16,000	65	0	206	271
NORTH GEELONG	13,500	24,500	38,000	454	100	420	974
MARSHALL	28,000	13,500	41,500	387	55	750	1,192
WAURN PONDS	12,500	10,500	23,000	195	89	281	565

Table 2. Project Cost per Site

Stations	Project Cost
LARA	\$10,762,328
NORTH SHORE	\$7,572,820
NORTH GEELONG	\$14,755,553
MARSHALL	\$18,619,744
WAURN PONDS	\$9,592,198
TOTAL	\$61,302,644

The estimated project cost for all the five car parking expansions is \$61,302,644.

Table 3. Cost Breakdown

GEELONG COMMUTER						AECOM
Short Term Plans Concept Estimate - Parking Lot Expansions (5 sites)						
PROJECT SUMMARY						
Code	Description	Quantity	Unit	Rate	Total	
		Total Site Area				
1	LARA	34,000	m2	317	\$10,762,328	
	Demolition & Site Preparation				\$693,600	
	Roads, Footpaths & Paved Areas				\$1,683,000	
	Parking Structure				\$0	
	Landscaping & External Fixtures				\$739,000	
	Services				\$2,415,000	
	Miscellaneous				\$112,900	
	Other Costs: Prelims, Margins, etc				\$5,118,828	
2	NORTH SHORE	16,000	m2	473	\$7,572,820	
	Demolition & Site Preparation				\$280,500	
	Roads, Footpaths & Paved Areas				\$865,800	
	Parking Structure				\$0	
	Landscaping & External Fixtures				\$1,057,600	
	Services				\$1,740,000	
	Miscellaneous				\$27,100	
	Other Costs: Prelims, Margins, etc				\$3,601,820	
3	NORTH GEELONG	38,000	m2	388	\$14,755,553	
	Demolition & Site Preparation				\$1,008,250	
	Roads, Footpaths & Paved Areas				\$2,270,600	
	Parking Structure				\$0	
	Landscaping & External Fixtures				\$871,200	
	Services				\$3,490,000	
	Miscellaneous				\$97,400	
	Other Costs: Prelims, Margins, etc				\$7,018,103	
4	MARSHALL	41,500	m2	449	\$18,619,744	
	Demolition & Site Preparation				\$883,688	
	Roads, Footpaths & Paved Areas				\$2,325,200	
	Parking Structure				\$0	
	Landscaping & External Fixtures				\$1,869,400	
	Services				\$4,566,250	
	Miscellaneous				\$119,200	
	Other Costs: Prelims, Margins, etc				\$8,856,007	
5	WAURN PONDS	23,000	m2	417	\$9,592,198	
	Demolition & Site Preparation				\$504,563	
	Roads, Footpaths & Paved Areas				\$1,472,200	
	Parking Structure				\$0	
	Landscaping & External Fixtures				\$667,900	
	Services				\$2,328,750	
	Miscellaneous				\$56,500	
	Other Costs: Prelims, Margins, etc				\$4,562,286	
TOTAL PROJECT COST (EXCL GST)					\$61,303,000	
Total project cost rounded to nearest thousands						
<i>Exclusions:</i>						
Re-zoning / planning fees costs		Bus / Taxi interchange				
Contamination removal allowance (Cat A / Cat B)		Land acquisition				
Escalation allowances		Project owner costs				
Road / Intersection works		Legal Fees				
Passenger information display screens		Contingencies				
Assumes that will be delivered as separate projects to contractors and not assigned to an alliance.						
Date Generated:						
7/12/2018 15:11						

3.0 Basis of Cost Plan

This cost plan is based on the scope outlined in AECOM's Geelong Commuter Parking report on 23 November 2018. The following has been assumed in the estimate:

- Cat C (if any) to be stored on site and not carted away
- Pedestrian pathway to be allowed from car park to station and length of car park only
- Excluding connections to mains, assume no alterations on the existing infrastructure services outside the sites
- For the new parking additions, we assumed 25m²/new general spot and 30m²/new accessible spot
- General site clearance assume at 100% to new sites and 30% to existing sites
- Excavation to reduce levels assumed up to 90% of the area of new sites

4.0 Specific Inclusions

The cost plan includes for all construction works as described inclusive of main contractor's preliminaries and margin. The estimate also includes for the following:

- Landscaping
- Allowance to make good existing infrastructure
- New footpath / shared path from car park to train station
- Ticketing machines (1 per 50)
- Accessible parking to additional parking (1 per 100)

5.0 Specific Exclusions

The following are excluded from the cost plan:

- Road / Intersection works
- Parking structure
- Removal of contaminated material including Cat A and Cat B
- Passenger information display screens
- Bus / Taxi interchange
- Project owner costs
- Land acquisition
- Items noted as 'Excluded' in the Cost Plan
- Legal fees
- Any alterations on existing infrastructure services outside the sites
- GST

6.0 Drawings and Information Used

- Geelong Commuter Parking - Working Draft 23-11-18_final.docx
- Email: 'Geelong Commuter - At-grade parking numbers confirmation' 05/12/2018

7.0 Escalation

Escalation has been excluded in this estimate.

8.0 Fees & Contingencies

The following project related costs and contingencies have been applied by percentage in the cost plan:

Table 4. Fees & Contingencies

Item	Percentage
Preliminaries and Overheads	15%
Margins	5%
Design Contingency	15%
Construction Contingency	12%